CLIMATE CHANGE

Scientific Assessment and Policy Analysis

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Differentiation in the CDM: options and impacts

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Differentiation in the CDM: options and impacts

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Wetenschappelijke Assessment en Beleidsanalyse (WAB) Klimaatverandering

Het programma Wetenschappelijke Assessment en Beleidsanalyse Klimaatverandering in opdracht van het ministerie van VROM heeft tot doel:

- Het bijeenbrengen en evalueren van relevante wetenschappelijke informatie ten behoeve van beleidsontwikkeling en besluitvorming op het terrein van klimaatverandering;
- Het analyseren van voornemens en besluiten in het kader van de internationale klimaatonderhandelingen op hun consequenties.

De analyses en assessments beogen een gebalanceerde beoordeling te geven van de stand van de kennis ten behoeve van de onderbouwing van beleidsmatige keuzes. De activiteiten hebben een looptijd van enkele maanden tot maximaal ca. een jaar, afhankelijk van de complexiteit en de urgentie van de beleidsvraag. Per onderwerp wordt een assessment team samengesteld bestaande uit de beste Nederlandse en zonodig buitenlandse experts. Het gaat om incidenteel en additioneel gefinancierde werkzaamheden, te onderscheiden van de reguliere, structureel gefinancierde activiteiten van de deelnemers van het consortium op het gebied van klimaatonderzoek. Er dient steeds te worden uitgegaan van de actuele stand der wetenschap. Doelgroepen zijn de NMP-departementen, met VROM in een coördinerende rol, maar tevens maatschappelijke groeperingen die een belangrijke rol spelen bij de besluitvorming over en uitvoering van het klimaatbeleid. De verantwoordelijkheid voor de uitvoering berust bij een consortium bestaande uit PBL, KNMI, CCB Wageningen-UR, ECN, Vrije Universiteit/CCVUA, UM/ICIS en UU/Copernicus Instituut. Het PBL is hoofdaannemer en fungeert als voorzitter van de Stuurgroep.

Scientific Assessment and Policy Analysis (WAB) Climate Change

The Netherlands Programme on Scientific Assessment and Policy Analysis Climate Change (WAB) has the following objectives:

- Collection and evaluation of relevant scientific information for policy development and decision–making in the field of climate change;
- Analysis of resolutions and decisions in the framework of international climate negotiations and their implications.

WAB conducts analyses and assessments intended for a balanced evaluation of the state-of-the-art for underpinning policy choices. These analyses and assessment activities are carried out in periods of several months to a maximum of one year, depending on the complexity and the urgency of the policy issue. Assessment teams organised to handle the various topics consist of the best Dutch experts in their fields. Teams work on incidental and additionally financed activities, as opposed to the regular, structurally financed activities of the climate research consortium. The work should reflect the current state of science on the relevant topic.

The main commissioning bodies are the National Environmental Policy Plan departments, with the Ministry of Housing, Spatial Planning and the Environment assuming a coordinating role. Work is also commissioned by organisations in society playing an important role in the decision-making process concerned with and the implementation of the climate policy. A consortium consisting of the Netherlands Environmental Assessment Agency (PBL), the Royal Dutch Meteorological Institute, the Climate Change and Biosphere Research Centre (CCB) of Wageningen University and Research Centre (WUR), the Energy research Centre of the Netherlands (ECN), the Netherlands Research Programme on Climate Change Centre at the VU University of Amsterdam (CCVUA), the International Centre for Integrative Studies of the University of Maastricht (UM/ICIS) and the Copernicus Institute at Utrecht University (UU) is responsible for the implementation. The Netherlands Environmental Assessment Agency (PBL), as the main contracting body, is chairing the Steering Committee.

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Preface

This report has been commissioned by the Netherlands Programme on Scientific Assessment and Policy Analysis (WAB) Climate Change. This report has been written by the Energy research Centre of the Netherlands (ECN) and the Institute for Environmental Studies (IVM) of the Vrije Universiteit Amsterdam.

We would like to thank the Steering Committee for this research project, consisting of Gerie Jonk (Netherlands Ministry of Environment), Wytze van der Gaast (Joint Implementation Network) and Jos Cozijnsen (Environmental Defense Fund) for their useful guidance and comments throughout the research period. Lambert Schneider, Raekwon Chung, Jos Sijm, and Onno Kuik reviewed draft versions of this report. Their helpful comments are greatly appreciated. Ralph Lasage provided assistance in preparing the figure for Chapter 4. However, the sole responsibility for the contents is with the authors.

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Executive Summary

The CDM aims to achieve two main goals: cost-effective compliance with the Kyoto Protocol for Annex B countries through GHG emission reductions in non-Annex I countries and contributing to sustainable development in non-Annex I countries. The functioning of the CDM has shown that achieving multiple goals with one policy instrument is generally difficult – a truly double-edged sword is hard to find. In this regard, some of the main perceived problems of the CDM are:

- The difficulties in demonstrating additionality of many projects.
- The 'offsetting-only' character of the CDM.
- Its limited contribution to sustainable development.
- An unequal regional distribution of CDM projects among non-Annex I host countries.
- The unequal distribution of CDM projects among sectors.
- High windfall profits for certain project types.
- Transaction costs due to the institutional and governance structure.

In order to address these issues, various options for differentiation in the CDM have been proposed by policymakers and academics. Differentiation is preferential treatment to compensate for market imperfections or less desired outcomes. This report looks into options that aimed at two forms of differentiation in particular: 1) between Parties; and 2) between project types.

To some extent, differentiation is already applied under the current rules, for instance by excluding LDCs from the CDM levies; allowing simplified procedures for small-scale projects; or excluding some project types (e.g. nuclear energy). In addition, there is already differentiation in the buyer's market, particularly with regard to the sustainable development contribution through, for example, the CDM Gold Standard. This report provides an overview of some of the main proposed options for differentiation, including examples of how to implement them by showing a possible basis for differentiation. Finally, this report analyses the possible qualitative impacts of differentiation for the institutional governance structure of the CDM and quantitative impacts on the carbon market.

Impacts of differentiation options
We identify a list of criteria for differentiation between Parties (both Annex I and non-Annex I) and project types. In this report we show what differentiation between countries could look like based on the criteria of 'responsibility' (CO_2 emission per capita) and 'capability' (GNI per capita). Differentiation between project types could be based on their (potential) impacts on sustainable development, use of certain technologies, the likelihood of additionality, and the risk of windfall profits (for non-CO_2 options).

The most important differentiation options and their possible implications are provided in a preliminary assessment of the options against a number of criteria. The evaluation strongly depends on how the differentiation options are implemented (e.g. the impact of multiplication by a factor of 5 will be much higher compared to a factor of 1.5), and, on a number of occasions, on expert judgement.

It should be noted that this report has looked at differentiation in the CDM in isolation. For policymakers, the discussion should be seen in a broader context of the role of CDM in mitigation over the longer term, which may render CDM differentiation less or more desirable. This includes reform of the CDM to possible new approaches including sectoral approaches, differentiation in mitigation action between non-Annex I parties and the fundamental architecture of a Copenhagen agreement.

From the analysis in this report we conclude:

- Preferential treatment for underrepresented host countries or preferable project types appears to be an option without significant negative impacts, but its contribution to improved regional distribution and sustainable development is likely to be limited. It can therefore be

considered a 'doesn't-hurt' option, which is insufficient to significantly change the sectoral and regional distribution, but could still provide support to some countries and project types bypassed by the CDM so far.

- Thresholds for sustainable development set on an international level and verified by DOEs may improve the sustainable development profile of the CDM project portfolio. However, quantifying sustainable development benefits has been shown to be problematic, while consensus on such standards may not be feasible and they are likely to be difficult to administer. In addition, it would be very difficult to define SD standards at the international level, since they would have to fit specific circumstances and development priorities of individual host countries.
- Differentiation based on quota or eligibility of Parties or project types could significantly change the regional distribution of CDM projects. However, the CER supply potential will decrease and these options are likely to be difficult to reach agreement on in negotiations. The supply of credits would likely be reduced, but would be sufficient to meet most 2020 demand scenarios.
- Discounting of CERs can contribute positively to most of the issues, in particular by creating a mechanism that results in net global GHG emission reductions (if the discount rates are higher than the share of non-additional projects being registered in the system). Also the discount rates can be applied and adjusted such that underrepresented countries in the CDM market benefit, as well as technologies with strong contributions to sustainable development (if identified). Windfall profits may be reduced by application of supply-side CER discounting to appropriate technology types. The most important drawback is that it is likely to be difficult to negotiate the discount rates. On the market side, the option will have an impact on both the abatement cost and potential of mitigation options. Global supply of credits is likely to suffice to meet the demand (projected to be 0.5-1.7 $GtCO_2$-eq/yr in 2020) for the discount factors applied in the illustrative analysis in this report (i.e. CER multiplication factor of 0.75 for medium income / medium-high emissions per capita countries; 0.5 for HFC-23, N_2O and fugitive methane projects).

Overall it can be concluded that there are clear trade-offs: the options that most likely are easiest to agree on have the smallest negative impact on the CDM's functioning as a market mechanism, but also the smallest positive impact on sustainable development and the geographical distribution of projects. In that regard, the various ways of preferential treatment are likely the easiest to implement. To find a balance between the CDM's different objectives, the middle-of-the-road options could be explored in more detail.

In addition, discounting could be explored, as it is an option which could be introduced gradually. The most challenging option may be the explicit exclusion of countries from participation in the CDM, although it would address the geographical imbalance most directly. Differentiation between project types could be more straightforward than differentiation between Parties. If differentiation between Parties could be agreed upon in the broader framework of a new climate agreement, i.e. not related to the flexible mechanisms specifically, then it may be sensible to extend the same country classification to the CDM.

Although carbon market impacts could be significant for individual countries or technologies, for instance through reduced CER supply, the supply of CERs is likely to remain sufficient to meet projected demand. The overall cost-effectiveness could decrease somewhat, but discounting specific low-cost options may also reduce windfall profits. If multiplication or discounting would be applied to projects from specific host countries or technologies, it needs to be balanced by discounting of other options in order not to create increases in global emissions. It therefore needs careful consideration. We show that the largest share of the potential for emission reductions is in the realm of energy efficiency and renewable energy. In case CERs from these projects are multiplied it is not likely that this can be balanced by discounting of other options.

Policy recommendations:

- *Discussing differentiation options*: although differentiation options may be difficult to agree upon, they may be worthwhile discussing internationally given the need for finding solutions to address the various concerns about the CDM. This includes the use of discounting and eligibility of parties and technologies. The current negotiations in the AWG-KP already made

a start in this regard, by discussing the advantages and drawbacks of various options mentioned in this report. However, given the importance of the design of a specific option, there is still room to discuss the options and their implications in more detail.

- *Continue preferential treatment*: Preferential treatment should be continued in order to support investments in countries and project types that have been bypassed by the CDM, even if only to a limited extent.
- *Unilateral implementation*: In case no international agreement is reached on differentiation in the CDM, some options may still be implemented by countries. Notably, the use of a minimum threshold for sustainable development benefits, or allocating demand to specific countries or project types do not necessarily require an international approach.
- *Discussion of criteria:* Although the design and implementation of several differentiation options might be difficult to agree upon at the international level, there are clear rationales for differentiating between Parties and project types. At the very least, Parties to the UNFCCC and the Kyoto Protocol could discuss the reasons for differentiation, and where possible, discuss possible criteria for differentiating. These discussions should be informed by sound science and data regarding the economic and social circumstances of Parties, and the characteristics of certain project types.

Research recommendations:

Differentiation in the CDM has only received limited attention in the literature, although it could potentially address some of the concerns raised about the mechanism. Although this report sought to provide a first discussion of the possible options and impacts, a number of issues may be explored in more detail:

- *Criteria for differentiation between project types*: Whereas the general literature on differentiation between Parties has provided insights into the possibilities and limitations of criteria for country differentiation, possible criteria for differentiation between project types are less clear. In particular, it is unclear how to deal with project types that exhibit similarities (e.g. renewable energy), but at the same time also differences (e.g. in terms of additionality). Furthermore, it could be examined in more detail how various ways of differentiating between project types (e.g. in terms of contribution to sustainable development vs technology used) compare.
- *Design implications*: The design details of several options (e.g. discounting/multiplication; preferential treatment) are still largely undetermined, but could have important implications. In particular, a more detailed assessment of the use of different discount factors in terms of market impacts could be useful.
- *Interaction with other CDM reform options*: This report has mainly addressed the differentiation options in isolation from other proposals for CDM reform. In practice, however, these options will likely interact, as they may seek to address the same concerns. For instance, how would the effectiveness of selected differentiation options in addressing concerns about the CDM be affected by a form of a sectoral crediting mechanism? Furthermore, differentiation options that exclude certain project types or countries likely need to be accompanied by other mitigation actions. In this regard, how could differentiation in the CDM be related to the discussion on nationally appropriate mitigation actions, or what would be the possibilities to establish other funding mechanisms for projects that are excluded from the CDM?
- *Analysis of market impacts* of differentiated discount factors and other options provide a possibility for further investigation, e.g. for combinations of options mentioned in this report, REDD, or a combination with sectoral approaches. In particular the impact for individual host Parties and technologies needs further attention. Also the impact of selected options (discounting, preferential treatment) on various actors in the CDM could be explored further.

In a broader perspective the research question remains how a reformed CDM can function in any successful Copenhagen agreement. This includes alignment or integration of the two negotiation tracks AWG-KP and AWG-LCA on the issue of flexible mechanisms, perverse incentives from the CDM towards mitigation actions in developing countries, and the functioning of the CDM in the absence of an AWG-KP international agreement on emission reductions.

Samenvatting

Het CDM heeft de volgende twee doelstellingen: betaalbare broeikasgasemissiereducties in non-Annex I landen die door de Annex I landen gebruikt kunnen worden om aan hun doelstellingen te voldoen en tegelijkertijd bijdragen aan de duurzame ontwikkeling in non-Annex I gastlanden. De manier waarop het CDM functioneert heeft aangetoond dat het behalen van meerdere doelstellingen met één beleidsinstrument doorgaans lastig is. Enkele problemen die bij het CDM ervaren worden zijn:

- Problemen bij het aantonen van de toegevoegde waarde van vele projecten.
- Het 'slechts compenserende' karakter van het CDM.
- De beperkte bijdrage aan duurzame ontwikkeling.
- Een scheve regionale verdeling van CDM-projecten tussen non-Annex I gastlanden.
- De scheve verdeling van CDM-projecten tussen sectoren.
- De windfall profits van sommige projecten, en
- Transactiekosten die voortkomen uit de institutionele en bestuurlijke structuur.

Om deze problemen aan te pakken zijn verschillende differentiaties in het CDM voorgesteld door beleidsmakers en academici. Dit rapport gaat in op de opties die specifiek gericht zijn op twee vormen van differentiatie: 1) tussen partijen en 2) tussen typen projecten.

Tot op zekere hoogte wordt differentiatie reeds toegepast onder de huidige regels, bijvoorbeeld door het uitsluiten van minst ontwikkelde landen (LDC's) ten aanzien van CDM-heffingen, het toestaan van vereenvoudigde procedures voor kleinschalige projecten of het uitsluiten van bepaalde typen projecten (bijv. nucleaire energie). Bovendien bestaat er al differentiatie aan de vraagkant, vooral met betrekking tot de bijdrage aan duurzame ontwikkeling door middel van, bijvoorbeeld, de CDM Gold Standard. Dit rapport geeft een overzicht van een aantal belangrijke beleidsopties voor differentiatie, inclusief voorbeelden van de manier waarop deze geïmplementeerd kunnen worden door een mogelijke basis voor differentiatie aan te geven. Tenslotte worden in dit rapport de mogelijke invloeden van differentiatie voor de bestuurlijke structuur van het CDM en de CO_2-markt geanalyseerd.

Differentiatie tussen partijen (zowel Annex I als non-Annex landen) kan gebaseerd worden op verschillende criteria. In dit rapport laten we zien hoe differentiatie tussen landen eruit zou kunnen zien op basis van het criterium 'verantwoordelijkheid' (CO_2-emissie per capita) en 'vermogen' (inkomen per capita). Differentiatie tussen projecten zou gebaseerd kunnen worden op hun (potentiële) impact op duurzame ontwikkeling, het gebruik van bepaalde technologieën, de aannemelijkheid van hun additionaliteit en het risico op windfall profits).

De meest belangrijke differentiatieopties en hun mogelijke gevolgen worden besproken in Hoofdstuk 7. Hierin wordt een voorlopige evaluatie van de opties afgezet tegen een aantal criteria, waarvan een aantal voortvloeit uit de voorafgaande hoofdstukken. De differentiatie hangt sterk af van de manier waarop de differentiatieopties geïmplementeerd zijn (bijv. de impact van CER-vermenigvuldiging met een factor 5 zal groter zijn in vergelijking met een factor 1,5) en, in een aantal gevallen, het oordeel van experts.

Het dient opgemerkt te worden dat dit rapport differentiatie in het CDM als op zichzelfstaand heeft bekeken. Beleidsmakers zouden deze discussie echter in een bredere context moeten zien waardoor CDM-differentiatie in toenemende of mindere mate aantrekkelijk wordt. Dit betreft onder andere aanpassing van het CDM aan mogelijke nieuwe methoden, inclusief sectorale methoden, differentiatie in mitigatie-acties (bijvoorbeeld NAMA's) tussen non-Annex I partijen en de fundamentele architectuur van een Kopenhagen-overeenkomst.

Uit de analyse in dit rapport komen de volgende zaken naar voren:
Voorkeursbehandeling voor ondervertegenwoordigde gastlanden of voorkeur voor projecttypen lijken opties te zijn waarbij geen belangrijke negatieve invloeden optreden, maar de bijdrage aan een betere regionale verdeling en duurzame ontwikkeling zal waarschijnlijk beperkt zijn. Het kan daarom als een 'no-lose' optie worden beschouwd, wat onvoldoende is om de sectorale

en regionale verdeling aanzienlijk te veranderen, maar toch enige steun kan bieden aan landen en projecttypen die tot dusver omzeild worden door het CDM.
Drempels of criteria voor duurzame ontwikkeling die op een internationaal niveau bepaald en geverifieerd worden door DOEs kunnen het duurzame ontwikkelingsprofiel van het CDM-portfolio mogelijk verbeteren. Echter, het kwantificeren van duurzame ontwikkeling is wetenschappelijk en politiek problematisch gebleken. Bovendien is het moeilijk om normen voor duurzaamheidsontwikkeling te definiëren en toe te passen op een internationaal niveau, aangezien ze moeten passen bij de specifieke omstandigheden en ontwikkelingsprioriteiten van elk afzonderlijk gastland.
Differentiatie op basis van quota of uitsluiting van partijen of technologieën zou de regionale verdeling van CDM-projecten aanzienlijk kunnen veranderen. Het CER-leveringspotentieel zal echter afnemen en over deze opties zal vanuit politiek oogpunt moeilijk te onderhandelen zijn. De levering van credits zal waarschijnlijk afnemen, maar afdoende zijn om tegemoet te komen aan de meeste 2020 vraagscenario's.
Discounting van CERs kan een positieve bijdrage leveren aan de meeste zaken, vooral door een mechanisme te creëren dat leidt tot netto mondiale emissiereducties (als het discountingspercentage rate hoger is dan het aandeel niet-additionele CERs in het systeem). Verder kan het discountingpercentage toegepast en aangepast worden zodat landen die ondervertegenwoordigd zijn op de CDM-markt ervan profiteren, alsmede technologieën die sterk bijdragen aan duurzame ontwikkeling (indien erkend). Windfall profits kunnen verminderd worden door toepassing van aanbodzijde CER-discounting aan geschikte technologietypen. Het belangrijkste nadeel is dat over de discountingpercentages waarschijnlijk moeilijk te onderhandelen zijn. Aan de kant van de markt zal de optie impact hebben op zowel de reductiekosten en het potentieel van mitigatieopties. Mondiale levering van credits zal waarschijnlijk voldoen aan de vraag (geraamd op 0,5-1,7 $GtCO_2$-eq/jr in 2020) ten aanzien van de discountfactoren die zijn toegepast in de illustratieve analyse in dit rapport (d.w.z. CER-vermenigvuldigingsfactor 0,75 voor modaal inkomen/gemiddelde-hoge emissies per capita landen; 0,5 voor HFC-23, N_2O en vluchtige methaanprojecten).

Over het geheel genomen kan geconcludeerd worden dat er duidelijke wisselwerkingen zijn: de opties die politiek gezien het meest haalbaar zijn hebben de minste impact op het functioneren van het CDM als marktmechanisme, maar ook op duurzame ontwikkeling en de geografische verdeling van projecten. In dat opzicht zijn de verschillende manieren van voorkeurs-behandeling waarschijnlijk het meest eenvoudig te implementeren. Om een balans te vinden tussen de verschillende doelstellingen van het CDM zouden de middle-of-the-road opties nader bestudeerd kunnen worden. Discounting zou nader bestudeerd kunnen worden aangezien het een optie is dat geleidelijk toegepast kan worden. De optie die de meeste uitdaging biedt kan de expliciete uitsluiting van deelname van landen in het CDM zijn. Tegelijkertijd zou deze optie de geografische onbalans het meest direct kunnen aanpakken. Differentiatie tussen projecttypen zou politiek gezien beter haalbaar kunnen zijn dan differentiatie tussen partijen. Als er overeenstemming zou kunnen worden bereikt over differentiatie tussen partijen in het bredere raamwerk van een nieuwe klimaatovereenkomst, d.w.z. niet specifiek gerelateerd aan de flexibele mechanismen, dan lijkt het verstandig om dezelfde landenclassificatie toe te passen op het CDM.

Impact op de koolstofmarkt zou aanzienlijk kunnen zijn voor individuele gastlanden of technologieën, bijvoorbeeld door middel van een gereduceerd potentieel voor CER-aanbod. Waarschijnlijk zal de CER-aanbod voldoende te zijn om aan de geraamde vraag te voldoen. De algehele kosteneffectiviteit zou wat kunnen afnemen, maar discounting van andere goedkopere opties zou windfall profits ook kunnen verminderen. Als CER-vermendigvuldiging zou worden toegepast op projecten uit bepaalde gastlanden of technologieën moet dit in balans worden gebracht door discounting van andere opties om stijgingen in mondiale emissies te voorkomen. Dit moet dus zorgvuldig worden overwogen. We tonen aan dat het grootste deel van potentiële emissiereducties te vinden is op het terrein van energie-efficiëntie en hernieuwbare energie. Als CERs uit deze projecten vermeerderd worden is het onwaarschijnlijk dat dit in balans kan worden gebracht door discounting van andere opties.

Beleidsaanbevelingen

- *Bespreken van differentiatieopties*: hoewel het moeilijk kan zijn om overeenstemming te bereiken over differentiatieopties, is het de moeite waard deze internationaal te bespreken gezien de noodzaak om oplossingen te vinden voor diverse zorgen ten aanzien van het CDM. Dit houdt ook in het gebruik van discounting en uitsluiting van partijen en technologieën. In de huidige onderhandelingen in de AWG-KP wordt hier al mee begonnen door de voor- en nadelen van verschillende opties die ook in dit rapport genoemd worden te bespreken. Gezien het belang van het ontwerpen van een specifieke optie is er ruimte voor verdere discussie van de opties en hun implicaties.
- *Voorkeursbehandeling voortzetten*: De voorkeursbehandeling zou voortgezet moeten worden om investeringen te steunen in landen en projecttypen die door het CDM omzeild worden, al is het maar in geringe mate. Voorkeursbehandeling wordt al geïmplementeerd, onder andere via het Nairobi Framework, dat zich richt op het vergroten van het aandeel Sub-Sahara Afrika in de CDM-markt.
- *Unilaterale implementatie*: Indien er geen internationale overeenkomst wordt bereikt over differentiatie in het CDM, kunnen sommige opties nog door landen afzonderlijk worden geïmplementeerd. Met name het gebruik van een minimum drempel voor duurzame ontwikkelingsvoordelen, of het toebedelen van vraag aan specifieke landen of projecttypen vereisen niet direct een internationale aanpak.
- *Bespreking van criteria*: Hoewel het moeilijk zal zijn om op internationaal niveau overeenstemming te krijgen over het ontwerp en de implementatie van verschillende differentiatieopties, zijn er duidelijke beweegredenen voor differentiatie tussen Partijen en projecttypen. Op zijn minst zouden Partijen van de UNFCCC en het Kyoto Protocol kunnen praten over de redenen tot differentiatie en, waar mogelijk, ook over mogelijke criteria voor differentiatie. Deze besprekingen zouden gevoed moeten worden door degelijke wetenschap en data met betrekking tot de economische en maatschappelijke omstandigheden van de Partijen en de karakteristieken van sommige projecttypen.

Aanbevelingen voor verder onderzoek:

Differentiatie in het CDM heeft tot dusver beperkte aandacht gekregen in de literatuur, hoewel het in principe een aantal zorgen omtrent het mechanisme zou kunnen aanpakken. Hoewel dit rapport als doel heeft een eerste discussie op te starten over de mogelijke opties en invloeden, zouden de volgende zaken nader onderzocht kunnen worden:

- *Criteria voor differentiatie tussen projecttypen*: De algemene literatuur heeft inzicht gegeven in de mogelijkheden en beperkingen van criteria per land, maar mogelijke criteria voor differentiatie tussen projecttypen zijn minder helder. Het is met name onduidelijk hoe omgegaan moet worden met projecttypen die overeenkomsten tonen (bijv. hernieuwbare energie) maar tegelijkertijd ook verschillen (bijv. in termen van additionaliteit). Verder zou nader kunnen worden bekeken hoe verschillende manieren van differentiatie van projecttypen (bijv. in termen van bijdrage aan duurzame ontwikkeling versus technologiegebruik) zich tot elkaar verhouden.
- *Ontwerpimplicaties*: De ontwerpdetails van verschillende opties (bijv. discounting/ vermenigvuldiging; voorkeursbehandeling) zijn voor het grootste deel nog niet vastgesteld, maar zouden belangrijke gevolgen kunnen hebben. Met name een meer gedetailleerde evaluatie van het gebruik van verschillende discountfactoren met betrekking tot impact op de markt zou zeer nuttig kunnen zijn.
- *Interactie met andere CDM hervormingsopties*: Dit rapport heeft voornamelijk gekeken naar de individuele differentiatieopties, los van de andere voorstellen voor CDM-hervorming. In de praktijk zullen deze opties waarschijnlijk een wisselwerking hebben, aangezien ze dezelfde zaken adresseren. Bijvoorbeeld, in welke mate wordt de effectiviteit van geselecteerde differentiatieopties beïnvloed in hun aanpak van zorgen omtrent het CDM door een vorm van een sectoraal crediting mechanisme? Verder zullen differentiatieopties die bepaalde projecttypen of landen uitsluiten waarschijnlijk gecombineerd moeten worden met andere mitigatieacties. In dit verband rijst de vraag hoe differentiatie in het CDM in verband kan worden gebracht met de discussie over NAMA's, of waar mogelijkheden liggen voor het vaststellen van andere financieringsmechanismen voor projecten die uitgesloten zijn van het CDM.
- *Analyse van marktinvloeden* van verschillende discountfactoren en andere opties schept mogelijkheden voor verder onderzoek, bijvoorbeeld van combinaties van opties die genoemd

zijn in dit rapport, REDD, of een combinatie van sectorale benaderingen. Vooral de impact voor individuele gastpartijen en technologieën vereisen meer aandacht. Daarnaast zou de impact van geselecteerde opties (discounting, voorkeursbehandeling) op actoren in het CDM nader kunnen worden bestudeerd.

In de bredere context blijft de vraag hoe een hervormd CDM kan functioneren in en bijdragen aan een succesvol Kopenhagen akkoord. Hieronder valt integratie of interactie van de twee onderhandelingssporen AWG-KP en AWG-LCA op punten van flexibele mechanismen, perverse prikkels van het CDM voor mitigatie in ontwikkelingslanden, en het functioneren van het CDM zonder een AWG-KP akkoord over emissiereducties.

List of acronyms

AOSIS	Alliance of Small Island States
AWG	Ad Hoc Working group
BRT	Bus Rapid Transit system
CAIT	Climate Analysis Information Tool
CAN	Climate Action Network
CCAP	Centre for Clean Air Policy
CCS	CO_2 capture and storage
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
COP	Conference of the Parties (to the UNFCCC)
DNA	Designated National Authority
DOE	Designated Operational Entities
EB	Executive Board
EE	Energy efficiency
EGTT	Expert Group on Technology Transfer
EU ETS	EU Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse gas
GNI	Gross National Income
GNP	Gross National Product
Gt	Giga (10^9) tonnes
GWP	Global Warming Potential
HDI	Human Development Index
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IGES	Institute for Global Environmental Studies
IPAM	Environmental Research Institute of Amazonia
IPCC	Intergovernmental Panel on Climate Change
ITL	International Transaction Log
KP	Kyoto Protocol
LCA	Long term Cooperative Action
LDC	Least Developed Country
LULUCF	Land-Use, Land-Use Change and Forestry
MAC	Marginal Abatement Cost
MOP	Meeting of the Parties (to the Kyoto Protocol)
Mt	Mega (10^6) tonnes
N_2O	Nitrous oxide
NAMA	Nationally Appropriate Mitigation Action
OECD	Organisation for Economic Cooperation and Development
OPEC	Oil and Petroleum Exporting Countries
RE	Renewable energy
REDD	Reducing Emissions from Deforestation and Degradation
SD	Sustainable development
SIDS	Small Island Developing States
TERI	The Energy Research Institute
UNCTAD	United Nations Commission on Trade and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	US Environmental Protection Agency

1 Introduction

1.1 Background

The objective of the Kyoto Protocol's Clean Development Mechanism (CDM) is twofold: to help Annex I[1] Parties achieving their Kyoto targets more cost-effectively and to support non-Annex I countries in achieving sustainable development and contributing to the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC).[2] Judging a project's contribution to sustainable development is the prerogative of the host country when approving the project. The greenhouse gas emission reductions realised by a project is assessed in a process established under the Kyoto Protocol in which the CDM Executive Board (CDM EB) plays a supervisory role.

The adoption of the Bali Action Plan (UNFCCC, 2007) established a process to arrive at a comprehensive international agreement to combat climate change beyond 2012, and there are now various discussions taking place on the future design of the CDM (UNFCCC, 2008a). In these discussions, a number of concerns with respect to the current functioning of the CDM have been put forward, some of them accompanied by proposals for reform.

Improving the current CDM architecture, rules and procedures and expanding the scope of the CDM beyond a project basis has been studied extensively (e.g. Cosbey et al., 2005; 2006; 2007; Michaelowa, 2005; Sterk and Wittneben, 2006). There are also various studies that concern new mechanisms to scale up the mitigation contribution of developing countries (e.g. sectoral crediting approaches) (e.g. Bodansky, 2007; Bosi and Ellis, 2005; Schmidt et al., 2006). However, comprehensive analyses of options to differentiate the CDM among project types or host countries, which could improve the sectoral and regional distribution of the CDM, are still largely missing.[3] This study aims to fill this gap by providing an overview and analysis of differentiation options within the CDM that would improve opportunities of the CDM for specific project types or host countries.

Differentiation is conceivable in many ways. Not only could one differentiate between CDM project types and host countries, but also between the size of the project (from small-scale to possible sectoral CDM), between a project's contribution to sustainable development, technology used, or technology transfer involved, etc. For the purpose of this study, however, our main categorisation is focused on differentiation between project types and between Parties.

Although we focus the report on differentiation options within the CDM, this issue should not be seen in isolation and is part of a broader discussion on post-2012 climate action and the role of the carbon market to support this. For example, limiting the supply of Certified Emission Reductions (CERs) from certain project types and/or host countries does not mean that these technologies or countries should not receive support to reduce emissions. In this regard, the interaction with the scope and design of nationally appropriate mitigation actions (NAMAs; UNFCCC, 2007; 2009a) could be significant.

[1] This report does not refer to Kyoto Protocol Annex B countries, but only to Annex I countries.
[2] Article 12.2 of the Kyoto Protocol.
[3] As we will show in the next chapters, the CDM literature has certainly not ignored the issue altogether. Many authors have at least discussed some aspects of differentiation in their discussions of CDM reform.

1.2 Objectives and scope

On the basis of the foregoing, this report provides:

- *An overview of possible options for differentiation in the CDM between different project types and between host countries.*
- *A qualitative assessment of the practical feasibility of a number of selected options, with a focus on possible criteria for differentiation and institutional and governance implications.*
- *An assessment of possible impacts on the supply of CDM credits in the carbon market, including the impact on the total supply of credits after 2012 as well as from specific technologies and regions, and possible impacts on carbon prices.*

The assessment contained in this report should mainly be seen as a 'what-if' analysis. In order to investigate implications of CDM differentiation options it makes specific assumptions about how these options would be implemented. The options should therefore be regarded as illustrative examples of proposals that could be considered by policymakers and not as policy recommendations.

As the focus is specifically on CDM differentiation options, this study will only marginally address links with other CDM reform discussions, including sectoral/programmatic CDM and broader sectoral approaches. Programmatic CDM is already being implemented under the CDM and can be implemented in any host country and for any technology. Therefore we do not regard this as a new differentiation option. In the same vein this report does not deal with sectoral approaches, which in principle could also be differentiated among countries or sectors. Finally reduced emissions from deforestation and degradation (REDD) and CO_2 capture and storage (CCS) will only be discussed were relevant.

1.3 Outline

The report is structured as follows. After discussing several concerns that have been raised with regard to the current functioning of the CDM in Chapter 2, Chapter 3 provides a (non-exhaustive) list of policy options for differentiation in the CDM in a future climate regime, based on the existing literature. Given the salience of differentiation between Parties – also outside the CDM context – Chapter 4 discusses options for criteria for differentiation between Parties. Chapter 5 then provides a qualitative assessment of the possible legal and institutional implications of a selected number of options, and examines the possible impacts for different actors in the CDM. Chapter 6 presents a first quantitative analysis of the effects of some differentiation options on the global carbon market. In Chapter 7, a preliminary assessment of the differentiation options is carried out. Chapter 8 provides conclusions and recommendations.

2 Concerns about the CDM

This chapter briefly highlights some of the main concerns that have been raised with regard to the functioning of the current CDM. Suggestions for differentiation – discussed in the next chapter – have occasionally been targeted at one or more of these specific concerns. The extent to which a differentiation option addresses these concerns is the subject of our preliminary assessment in Chapter 7, in which we will apply criteria related to these concerns to several differentiation options.

2.1 Environmental effectiveness

The main concern with regard to the environmental effectiveness of the CDM relates to whether it contributes to global greenhouse gas emission reductions. In this regard, the first concern is that the CDM is a mechanism that does not in itself reduce emissions, but (at best, i.e. if all projects are truly additional) offsets the increase in emissions elsewhere. In response, there have been calls to move the CDM beyond an offsetting-only approach (Chung, 2007; Schatz, 2008; Schneider, 2009).

Another concern raised by several observers (Cames et al., 2007; Michaelowa and Purohit, 2007; Schneider, 2007; Victor and Wara, 2008; Haya, 2008) is that the additionality[4] of a significant share of CDM projects is questionable, and that proving additionality is inherently subjective, even though the degree of additionality may be different for different project types. Particularly those CDM projects that benefit from other financial sources than only the CERs, such as energy efficiency and renewables, are known for their complexity in assessing additionality.

2.2 Contribution to sustainable development

There are concerns about the contribution of the CDM to the sustainable development goal of the CDM. According to Article 12 of the Kyoto Protocol, one of the CDM's objectives is to contribute to sustainable development in host countries. Determining which projects contribute to sustainable development and which ones do not, however, is highly context-specific and subjective as countries and even regions or communities may have different views on what is sustainable, and what is development. This difficulty is part of the reason why the definition of sustainable development is left up to the non-Annex I host countries. Still, based on a comprehensive literature review, Holm Olsen (2007: 67) concludes that "left to market forces, the CDM does not significantly contribute to sustainable development". Furthermore, looking at indicators for economic, social and environmental development, Sutter and Parreño (2007) show that the greatest amounts of CERs are being generated by projects with the lowest or no contribution to sustainable development in the host countries. In the current project portfolio a large part of the CERs is generated by relatively cheap industrial gas projects (e.g. HFC-23 destruction) with no obvious sustainable development benefits (e.g. Schneider, 2007; Wara, 2008), even though one could argue that they still contribute to sustainable development from the host country perspective. In the past two years however renewable energy and energy efficiency are gaining importance, while the transport sector is still virtually absent (UNEP/Risø, 2009). However, barriers for the implementation of these projects still exist. One of these problems concerns additionality: since energy efficiency projects often pay for themselves through reduced energy costs over time (e.g. Driesen, 2006), and both (small-scale) renewable energy and energy efficiency projects typically generate few credits, making it difficult to demonstrate that without the CDM these projects would not have happened (e.g. Burrian, 2006; Matschoss, 2007).

[4] With additionality, we refer here to the general idea that a specific project activity would not have occurred without the CDM.

2.3 Regional distribution of projects

The CDM ideally provides an incentive for climate change mitigation projects throughout the developing world. However, soon after the start of the mechanism, it became clear that not everyone would benefit in the same way from the resources flowing from Annex B countries. The wording in Decision 17/CP.7 on regional distribution of CDM project activities is rather ambiguous. The decision (in its preamble) refers to "the need to promote equitable geographic distribution of clean development mechanism project activities at regional and subregional levels", but nowhere specifies what is meant with an "equitable geographic distribution". For instance, would this need to be interpreted in terms of number CDM projects in host countries; number of CERs generated in host countries; the number of projects/CERs per unit (e.g. population; GDP; total GHG emissions; etc.)? Cosbey et al. (2006) use three ways of showing the regional distribution: by absolute number of CERs per country and distribution corrected for GDP and population respectively. Even though the country ranking are different according to the method, all three distributions show large differences among countries, and in all cases the LDCs are underrepresented in the top half. The main point is thus that different interpretations of what constitutes 'equitable' would lead to different outcomes in terms of the distribution of project activities. Nevertheless, concerns have been raised with regard to regional distribution, mainly because most of the projects are being implemented in a limited number of countries (UNEP/Risø, 2009), and under most interpretations, there are few project activities in least-developed countries.

2.4 Sectoral distribution of projects

In order to achieve the ultimate objective of the UNFCCC, i.e. avoiding dangerous human interference with the climate system, substantial GHG reductions in all sectors are required over the long term. The IPCC (2007) distinguishes the following sectors: energy supply, transport, buildings, industry, agriculture, forestry and waste. In each of those sectors there is a large global GHG emission abatement potential (over 2 $GtCO_2$-eq/yr in 2030, except for waste). Looking at the CDM project portfolio of March 2009, however, it appears that the transport, building and forestry sectors are virtually absent, while energy supply, industry and waste are relatively successful (UNEP/Risø, 2009). This disparity of GHG reduction by CDM projects compared to the sectoral emission reduction potential, i.e. the sectoral distribution of CDM projects, has been highlighted by several authors (e.g. Schneider, 2008; Sterk, 2008; Zegras, 2007).

2.5 Institutional and governance issues

Concerns have been raised with regard to the institutional structure of the CDM, and associated difficulties for developing and implementing CDM project activities. These concerns relate to the requirements of the CDM project cycle, and the role of the CDM Executive Board and the Designated Operational Entities. A key concern is the length and complexity of the approval and registration process, which may lead to significant transaction costs (Streck, 2007; Streck and Lin, 2008; Boyle et al., 2009). In this context, it has been noted that transaction costs may provide a barrier particularly for small-scale CDM projects (e.g. Sterk and Wittneben, 2006). Although some transaction costs may be reduced over time, for example through project participants' increasing experience with the CDM or through the professionalisation of the CDM EB (Boyle et al., 2009), the concerns hold at least for the current institutional structure (Cames et al., 2008). Other concerns related to the governance of the CDM include the lack of regulatory and legal certainty provided to project participants. For instance, observers have questioned the independence of the CDM EB members, expressed doubts about the transparency of the decision-making process, and pointed to the lack of a review process of EB decisions (Streck, 2007; Streck and Lin, 2008).

2.6 Windfall profits

Finally, there are concerns that some project proponents (and host countries) have benefited from high windfall profits[5], as the costs of achieving some emission reduction have been very low compared to the CER revenues (Wara and Victor, 2008). This is particularly the case for destruction of industrial gases, particularly HFC-23, that have a much higher global warming potential (GWP) than CO_2, and very low abatement costs. This means that investors can receive much more CERs from reducing emissions from these gases compared to CO_2 emission reductions (Schatz, 2008: 719)[6]. In itself, profits from CDM projects are not something undesirable, as it is a market mechanism, in which issues related to distribution of wealth are common. However high windfall profits could be seen as not desirable, as this means that resources could have been used more effectively elsewhere.

[5] This can also be referred to as 'producer surplus' or 'economic rent'.

[6] The Chinese government however taxes these profits and uses these for investments in renewable energy and energy efficiency.

3 Options for differentiation in the CDM

This chapter presents an overview of various policy options for differentiation within the CDM in a future climate regime, based on a survey of the relevant literature and UNFCCC documents. A brief description of each option is provided, while a more in-depth discussion of some of the advantages and drawbacks of each option is provided in Chapter 7. Section 3.2 discusses various options for differentiation between Parties to the UNFCCC. Section 3.3 then discusses options for differentiation between project types. Finally, given that not all options are necessarily mutually exclusive, Section 3.4 discusses possible combinations of options for differentiation.

3.1 Overview

In order to clarify the terminology we use in this report, Table 3.1 gives a brief overview of the differentiation options that are discussed in this chapter.

Table 3.1 Overview of CDM differentiation options.

Differentiation between	Differentiation option	Explanation
Parties	Eligibility to host projects	Certain non-Annex I Parties are excluded from the CDM as host countries.
	Discounting/multiplication	CERs issued equal less or more than the achieved GHG reduction. Different discounting/multiplication factors are introduced for projects from different (groups of) host countries. Discounting may also be applied on the demand-side.
	Preferential treatment	Looser application of additionality test; funds for capacity-building; fast-tracking; levy differentiation.
	Cap on issuance	Introduction of a cap for each host country indicating the maximum amount of CERs that can be issued from projects implemented in the host country.
	Allocated demand	Annex I countries must purchase a minimum portion of CERs from particular host countries.
Project types	Positive list	No demonstration of additionality required for certain project types.
	Negative list	Project type(s) are excluded from the CDM or assumed to be non-additional.
	Discounting/ multiplication	CERs issued equal less or more than the achieved GHG reduction. Different discounting/multiplication factors are introduced for different project types. Using ambitious benchmarks may also be part of this.
	Minimum threshold for sustainable development benefits	Projects need to quantify and demonstrate their sustainable development benefits to be eligible.
	Preferential treatment	Looser application of additionality test; fast-tracking; funding for capacity-building; levy differentiation.
	Cap on issuance	Introduction of a cap indicating the maximum amount of CERs that can be issued from certain project types.
	Allocated demand	Annex I countries must purchase a minimum portion of CERs from particular project types.

3.2 Differentiation between Parties

3.2.1 Eligibility

Perhaps the most straightforward option for differentiation between Parties is to limit the countries/Parties that would be (in)eligible to participate in the CDM (UNFCCC, 2008a; 2008b) as host country and/or investor country[7]. For example, certain non-Annex I countries could be excluded from the eligibility to host CDM projects. For certain Annex I countries, eligibility to use CERs for compliance purposes could also be limited (UNFCCC, 2008a). For example, eligibility could be made conditional on reducing a minimum amount of emissions domestically (by imposing a quantitative restriction on the use of CDM credits).

3.2.2 Discounting/multiplication

Another option for differentiation between Parties would be to discount or multiply CERs from CDM projects implemented in certain host countries. This means, in effect, that a reduction of one tonne of CO_2-eq. emissions is no longer equivalent to one CER. Options for implementing discounting include discounting in the process of issuance (supply side) to the project developer by the Executive Board or when they are used by Annex I countries (demand side) (Schneider, 2008). In the remainder of this report we will mostly deal with supply side discounting.

Discounting could be applied across the board, by discounting all CERs by the same percentage for all countries and project types (Sterk, 2008). Discounting could, however, also be used to differentiate between host countries by applying a different discount rate to different countries (Schatz, 2008). For some countries, no discount rate may be applied at all (Chung, 2007).

The other side of the coin of discounting is multiplication or, more accurately, the rewarding of preferable projects with more credits than the actual number of tonnes of emissions reduced.[8] For example, Parties could decide to award projects executed in specific countries, such as small island developing states (SIDS) and least-developed countries (LDCs), with a higher amount of CERs (IGES, 2005). In addition to singling out groups of countries like LDCs or SIDS, Parties could also decide to use specific criteria to differentiate between countries (see Chapter 4).

3.2.3 Preferential treatment

Preferential treatment of certain non-Annex I host countries by changing CDM procedures could take different forms.

First, the additionality requirement for selected projects in certain countries could be relaxed. For example, small-scale project activities in LDCs or SIDS could be exempted from additionality criteria (UNFCCC, 2008a; 2008b).

Second, funding for CDM activities could be channelled to particular countries. IGES (2006), for example, suggests establishing carbon funds targeting micro-scale CDM projects in LDCs and SIDS, and putting in place specific capacity building programmes to reduce transaction costs in these country groupings. To some extent, this option is already being implemented through the Nairobi Framework, a joint initiative of the UNFCCC secretariat, the United Nations Development Programme, the United Nations Environment Programme, the World Bank, and the African Development Bank, which is aimed at strengthening (sub-Saharan) Africa's position in obtaining CDM projects.[9] Under the framework, several activities are planned or ongoing to build capacity in this region. Other capacity-building initiatives, aimed at *inter alia* raising

[7] The term 'investor country' for the purposes of this report refers to countries buying CERs for compliance purposes, so this country is not necessarily involved in the implementation of the project.
[8] Multiplication in fact encompasses discounting, with the latter applying a multiplication factor <1.
[9] See http://cdm.unfccc.int/Nairobi_Framework/index.html.

awareness, building institutional capacity, and developing CDM projects, have also been initiated by a range of actors, albeit with mixed results (Okubo and Michaelowa, 2009). Another variation of this option is to finance validation, verification and certification through the UNFCCC (UNFCCC, 2008b). Specific capacity building for programmatic CDM could also be channelled to countries that are said to benefit particular from this type of CDM projects (UNFCCC, 2009b).

Third, requirements of the CDM project cycle could be made flexible for certain projects activities in specific countries, resulting in a fast-tracking of projects in some countries. For example, CERs could be issued for small-scale project activities in some host countries on the basis of validation of the project activity and certification of the emissions reductions only through DOEs, i.e. without the CDM EB registering such a project (UNFCCC, 2008a).

Fourth, the CDM levies could be differentiated (European Commission, 2008). The Marrakech Accords establish an adaptation levy of 2% of the issued CERs.[10] Furthermore, for each CER a fixed amount needs to be paid for administrative expenses.[11] To some extent differentiation already exists in the form of an exemption of the least-developed countries from the adaptation levy.[12] Furthermore, the administrative share of proceeds on CERs for LDCs has been abolished. If levies are increased for countries with higher levels of development, a question is how the levy revenues are to be used.

3.2.4 Cap on issuance

Parties to the UNFCCC or the Kyoto Protocol could also decide to agree on caps limiting the number of projects or the amount of CERs for host countries on an equitable basis. When the limit has been reached a country would become ineligible for hosting further CDM projects. The caps could be set at the level of UN regions or individual host countries (Banuri and Gupta, 2000), and could be enforceable through the CDM EB (Silayan 2005).

3.2.5 Allocated demand

In addition to caps on the issuance of credits, it is also possible to allocate a specific proportion of demand to specific (groups of) countries, so that a minimum amount of CERs used by Annex I countries for compliance purposes is purchased from specified host countries (Cosbey et al., 2006; UNFCCC, 2008a).[13] Individually, governments already have this possibility under the current rules of the CDM. However, theoretically Annex I Parties could commit themselves internationally to implement not more than a certain number of projects in, or use a certain amount of credits from certain host countries. This allocated demand could be expressed e.g. as “x per cent of all CERs used by Annex I countries for compliance shall come from host Parties in category y” (UNFCCC, 2008a: 19). For instance, Sokona et al. (1998), argue that one-third of the CDM projects should be implemented in Africa and/or in LDCs.

3.3 Differentiation between project types

3.3.1 Negative list

The first option for differentiation between project types is the exclusion of projects through a ‘negative list’. Such exclusion could occur by denying these projects eligibility a priori, as is already applied under the current CDM. Parties to the Kyoto Protocol have determined that “Annex I Parties are to refrain from using CERs generated from nuclear facilities to meet their commitments under Article 3.1”.[14] Furthermore, project types currently not eligible under the

[10] Decision 17/CP.7, at para. 15(a).
[11] The amounts are US$ 0.10/ CER issued for the first 15,000 tonnes of CO_2-eq., and US$ 0.20 for any amount in excess of 15,000 tonnes of CO_2-eq. (Decision 7/CMP.1, at para. 37).
[12] Decision 17/CP.7, at para. 15(b).
[13] As within host country groups investments might still flow to only a few countries, there may be pressure to set quota for smaller groups or single countries (UNFCCC, 2008a).
[14] Decision 17/CP.7, at preamble.

CDM are CO_2 capture and storage (CCS), land use, land-use change and forestry (LULUCF) activities other than afforestation or reforestation, such as reducing emissions from deforestation and degradation (REDD) or forest management, the destruction of HFC-23 in new HCFC-22 production facilities and large hydro power plants with a reservoir density below 4 W/m². Exclusion from eligibility is also already used in the EU ETS, which does not allow credits from LULUCF to be used for compliance.

The main project type for which the negative list approach has been suggested is the destruction of HFC-23 (Schneider et al, 2004; Wara, 2007; 2008). Wara (2007), for instance, argues that a separate HFC protocol could also serve to reduce emissions from HFC installations. Such a protocol could establish a fund, comparable to the Montreal Protocol's Multilateral Fund (Wara, 2008), so that no CDM project crediting would be needed anymore to achieve the desired emission reduction. Furthermore, the Global Environment Facility (GEF) could be a forum to deal with this project type (Schneider et al, 2004). The negative list approach could be used for all HFC projects, but could also focus only on HFC emissions from new plants (Cosbey et al., 2007). In the post-2012 discussions, it has also been suggested that negative lists could also be used to exclude projects that may lock-in fossil fuel dependent industries (including CCS) into fossil based technologies, or projects that adversely affect biodiversity.[15] Furthermore, negative lists could be used to exclude projects above a certain size (e.g. large hydropower projects).

Although excluding the 'low-hanging fruit' projects with high windfall profits from the CDM has received most attention (e.g. CAN, 2009), it may also be possible to exclude certain project types that are deemed to have high co-benefits, but have high transaction costs and questionable additionality, such as some renewable energy or energy efficiency projects.[16] These projects, which are still desirable from a development perspective, could be funded under other mechanisms.

3.3.2 Positive list

Project types on a positive list would be deemed to be additional by nature, and would therefore not be subject to the additionality test (UNFCCC, 2008a; CAN, 2009). This would thus replace the project-by-project testing of additionality of the listed project types, while leaving the process for other project types unchanged (CAN, 2009). The positive list could, for example, be based on the use of certain technologies, or the scale of a project (UNFCCC, 2008a).[17]

3.3.3 Discounting/multiplication

A further option to differentiate between project types would be to issue only a limited number of credits (Schneider, 2007; 2008; see also Section 3.2.2). For example, if a project with a low contribution to sustainable development (or with high windfall profits) in the host country reduces 100 tonnes CO_2-eq. emissions, only 50 (or 20, 60, 80, etc.) CERs could be issued, while more sustainable or innovative projects would receive the same amount of CERs (or have a smaller discount rate) (European Commission, 2008; Schatz, 2008; UNFCCC, 2008a; Schneider, 2008).

Projects with high sustainable development benefits or those using innovative technologies could also be rewarded with more CERs than 'regular' projects (multiplication). Chung (2007), for example, mentions the idea of multiplying CERs from renewable energy and energy efficiency projects by 10 or even 100 times in order to increase their commercial viability. As

[15] See also CAN (2009) for a list of suggested project types that could be included in a negative list.

[16] Perhaps the terms "excluding" or "negative list" are not fully appropriate in this case. Rather than "excluding" these projects from the CDM, they would be singled out for preferable treatment through another mechanism.

[17] CAN (2009) also notes another interpretation of a positive list approach: only those projects listed would be eligible for credits, while projects not listed would not be ineligible. This is in essence a reverse negative list, and will not be further discussed here.

rewarding additional credits to 'sustainable' projects does not reflect the real emission reductions of such projects, the amount of additional CERs rewarded would need to be offset by fewer CERs from discounted projects (UNFCCC, 2008a).

A form of discounting could also be to set baselines below business as usual, for example by basing these on ambitious benchmarks such as penetration rates for efficient appliances or emission per tonne of product. In this case, the level of discounting is based criteria of a more technical nature rather than policy preferences (Schneider, 2008).

3.3.4 Minimum threshold for sustainable development benefits

A further option for differentiating between project types is to require that projects demonstrate that they have at least certain co-benefits, in terms of contribution to sustainable development in host countries, or demonstrating technology transfer (UNFCCC, 2008b). Although, it is currently the prerogative of host countries to confirm that a project provides a contribution to sustainable development, the Executive Board could be mandated to consider the sustainable development co-benefits of a project in addition to the question of additionality (UNFCCC, 2008a; 2008b). In this way, CDM projects that do not meet this minimum threshold would be ineligible for credits. The sustainable development criteria could be set internationally or domestically, and could be evaluated by DOEs only or also by the EB.

Several authors have examined how the CDM contributes or could contribute to sustainable development, and have addressed the question of sustainable development criteria (see, for an overview, Holm Olsen, 2007). As is the case in current DNA practices, the contribution to sustainable development can be assessed in broad terms (i.e. does a project contribute to environmental, social and economic sustainability) or through checklists (Holm Olsen and Fenhann, 2008). In addition, the literature indicates that operationalisation is also possible by establishing a list of (measurable) indicators, and assigning weights to the indicators (e.g. Sutter, 2003; Netherlands Ministry of Foreign Affairs, 2008). The CDM Gold Standard is perhaps the most notable application of this approach. Checklists and multi-criteria assessments will more likely provide a detailed assessment of a certain project's (potential) sustainability contribution than the use of broad criteria. However, if sustainable development criteria are to be developed at the international level, a challenge will be to align the use of 'objective' criteria with local circumstances.

3.3.5 Preferential treatment

As was the case for differentiation between countries, preferential treatment of projects could take place in multiple ways.

A first option would be to increase the flexibility in the additionality requirement for certain project types. For example, Cosbey et al. (2006) also suggest that for small-scale (renewable energy) projects that have shown to bring a development dividend, a more simplified additionality test might suffice. ENTTRANS (2008) and Gaast et al. (2009) suggest that CDM projects which are based on an energy-service needs assessment, followed by a selection of suitable low-carbon technologies to meet those needs and which is supported by a technology familiarisation programme, are given a more positive treatment when determining additionality. The rationale for the latter is that such an assessment and the technology familiarization helps countries in selecting new technologies that would otherwise not have been selected as technology choices are often anchored in existing and/or familiar technologies. In combination with the CDM, these projects could then be considered to fulfil the additionality requirement.

A second possibility is to speed up processing times (e.g. shortening the review period for the registration of small-scale projects; Cosbey et al., 2005).

A third option would be to provide financial support through the Kyoto Protocol for capacity-building with respect to certain project types.

Fourth, differentiation between project types is possible by changing the rules on levies. Michaelowa (2005), for example, suggests implementing an increased adaptation levy for end-of-pipe non-CO_2 emission reduction projects. Similarly, IGES (2008: 100) proposes a differentiated tax or other fiscal measure on CERs "earned from policies with high climate and low developmental benefits". The tax would be similar to a domestic tax already in place in China (see Muller, 2007), but would be implemented under the UNFCCC. The tax could be based on the determination of the co-benefits of a project. It is unclear whether these authors are talking of a new tax, or about differentiating the existing levies.

3.3.6 Cap on issuance

Similar to setting limits for the number of CERs for host Parties, Parties could decide to set caps on the issuance of CERs from specific project types. After reaching a certain level of issued CERs a project type would not be eligible anymore. It has already been proposed to apply this to CCS projects, in which in a pilot phase CCS is fully eligible up to a certain number of projects or level of CO_2 reductions (UNFCCC, 2008a).

3.3.7 Allocated demand

Finally, an option for differentiating between project types is to establish minimum demand quotas for preferred project types (similar to the option described in 3.2.5) (Schneider, 2008). Annex I Parties would then need to show that they have purchased a minimum amount of these project types, e.g. a certain percentage of total CERs used for compliance (UNFCCC, 2008a), or an absolute number of CERs.

3.4 Combining options for differentiation

The options for differentiation listed above are not mutually exclusive. Indeed, the options frequently overlap, and a range of option combinations is (theoretically) possible. At a general level, any of the differentiation options for project types could be combined with options for differentiation between countries. For instance, ineligibility could be applied across the board for all countries, or for specific types of project activities (UNFCCC, 2008a). In other words, it could be decided that it is impossible to issue or use CERs for compliance purposes from CDM projects in country A, but also only for project type X in country A.

Discounting/multiplication also could be implemented for both Parties and project types at the same time (Schatz, 2008), although this will most likely further increase the complexity of introducing this option, as for each combination the most appropriate discount rate/multiplication factor needs to be decided upon (see also Chapter 5). Likewise, a quota system could be applied to both countries and project types at the same time, although this would also make such a system more complex.

In addition to combining differentiation options between Parties and between project types, certain options within each category also do not exclude each other. For example, the options mentioned under preferential treatment, such as the use of financial resources to promote preferred projects, could be combined with various other options, including discounting/multiplication, exclusion/inclusion from eligibility, and quota systems. A case-by-case examination would be necessary to avoid a duplication of efforts towards the same goal.

These are merely some examples of how options could be combined. Eventually, how they could be combined would depend on the objectives pursued with the options (if the options contribute to different goals, duplication of efforts is more likely to be avoided), and on the specific design of each option.

4 Differentiation between Parties in the CDM: why and how?

This chapter seeks to address the question: how could differentiation between Parties for the CDM work in practice? Differentiation between Parties is a sensitive issue, which has also received considerable attention outside of the CDM discussions (e.g. Winkler et al. 2006). On the one hand, it could be argued that developing countries have similar historical experiences, political structures and economic conditions (Gupta, 2007), and that differentiation between Parties would undermine the negotiation power of the block of G-77 and China. On the other hand, the Annex I/non-Annex I distinction has also been criticised for not reflecting the differences in national circumstances (e.g. Rajamani, 2003). Rather than discussing differentiation between Parties for all purposes in the climate regime, this chapter aims to shed light on how countries could be classified into different categories and how activities with respect to the CDM can be differentiated to given these classifications. The current CDM host country and project portfolio provides valuable information on which countries are successful in attracting CDM projects. It does not evaluate the options for differentiation between Parties discussed in Chapter 3, but rather illustrates how these options could be operationalised if Parties deemed them appropriate in the context of the CDM.

The chapter first shows how the UNFCCC and the Kyoto Protocol classify different countries, and explains the limitations of this classification (Section 4.1). Next, it explores the theory of 'graduation', which allows countries to graduate from one category to another based on predefined criteria, and its practical application to climate policy (Section 4.2). It then shows how differentiation between countries in the CDM could be operationalised (Section 4.3). Finally, it provides concluding thoughts (Section 4.4).

4.1 Differentiation between Parties in the UNFCCC and the Kyoto Protocol

The UNFCCC tends to treat its Parties as two major blocks – emerging from the initial classification of Parties into Annex I (including a richer Annex II) and the default category of non-Annex I countries. The same approach is reinforced in the Kyoto Protocol, which focused on Annex B and non-Annex B countries. However, the Convention and Protocol mention other categories of countries as well, including least-developed countries (LDCs), small island states, economies in transition, and countries whose economies depend on the export of oil (Gupta, 2000).

While the Annex I/B-non Annex I/B classification simplifies the negotiation process between two major negotiation blocks, it suffers from two major problems. First, the countries within each block are poorly classified, as the classification overlooks the enormous differences between countries within and between blocks. Second, the classification is not dynamic, in the sense that it does not take into account changing circumstances in countries.

With regard to the first point, some differences between and within country groups can be pointed out. The per capita income of Annex I/B countries varies considerably. The Human Development Index (HDI), which provides an indication of the level of development of a country, also differs significantly between Annex I countries, with countries in Eastern and Central Europe having relatively low HDI values. At the same time, the non-Annex I/B group also displays a wide variation.[18] Some of the non-Annex I countries (such as Singapore, United Arab Emirates) are as rich as the richest countries in the world. The non-Annex I/B group, however, also includes the group of least-developed countries (LDCs). Even within this group, though, the economic profiles of the 50 LDCs (see Annex B and C) are quite heterogeneous, with GNI per capita in 2007 ranging from low (Guinea Bissau US$200; Ethiopia US$220) to relatively high (Equatorial Guinea US$12,860; Maldives US$3200). However, their annual per capita CO_2 emissions in 2004 are generally very low (e.g. Chad 0.05t; Madagascar 0.1t; Malawi 0.1t) to low

[18] The data on emissions and income per capita can be found in Appendix C.

(e.g. Yemen 1t). The HDI is relatively low in Sierra Leone, Burkina Faso, Guinea Bissau, and Niger and higher in the Maldives, Samoa and Cape Verde. Other countries not included in Annex I/B are some of the rapidly growing developing countries. Some of these countries, including China, India, Brazil and South Africa, attract a large share of the amount of CERs in the CDM pipeline (see, for example, UNEP/Risø, 2009). Yet again, there are also significant differences between these countries, which implies that treating them as one group will not be easy. Brazil has the highest GNI per capita in 2007 (US$5,910), followed by South Africa (US$5,760), China (US$2,360) and then at a much lower rate India (US$950). The HDI in 2005 in Brazil (0.8) and China (0.777) are the highest.[19] South Africa's CO_2 emissions are the highest at 9.8t CO_2 per capita, followed by China (3.8), Brazil (1.8) and India (1.2). Furthermore, with respect to the CDM, it should be noted that there is a difference between countries with a large share in absolute terms (i.e. total amount of CERs), and countries with a large share in relative terms (i.e. CERs per capita). Interestingly, if the latter approach would be used for examining the regional distribution of CDM projects, China, Brazil, India and South Africa are not found in the top of the list (see Annex D, and Cosbey et al. (2006) for an earlier assessment).

The UNFCCC does not prevent differentiation between Parties. On the contrary, in line with its principle of common but differentiated responsibilities and capabilities, the Convention provides a legal argument in favour of differentiation between Parties with different contributions to the climate problem and different capacities to reduce emissions (Art. 3.1). Essentially, the principle provides a basis for treating countries differently if national circumstances vary. This was also acknowledged in the Bali Action Plan, which calls for "nationally appropriate mitigation actions" to be undertaken by developing countries (UNFCCC, 2008d). Like the UNFCCC, the Kyoto Protocol does not *per se* exclude differentiation between Parties.

4.2 Graduation and differentiation between countries in theory and practice

4.2.1 Graduation theory

Differentiation between countries has received a great deal of attention in the literature on 'graduation', which includes a dynamic classification of countries on the basis of pre-set criteria. The idea of 'graduation' was first raised in the development literature, which has most often referred to it as the possible shift of countries from the developing country group to the developed country group. In the North-South literature, the concept was seen as positive since there was a possibility for developing countries to enter the club of rich countries, but also as negative since many felt that this encompassed a sense of linearity based on the idea of unlimited growth potential for all (Chambers, 1997) and that this was used to divide and rule developing countries (cf. Gupta, 1997). There are controversy and rich theoretical discussions regarding the notions of North and South and related graduation (e.g. South Commission, 1990; Rivlin, 1995), and the objection to graduation is clearly expressed by former secretary general to the Commonwealth, Ramphal (1983: 18) who sees: "forces at work to dismantle the very concept of North and South - of developed and developing - as if by statistical permutations you can dispel the world's disparities. Concepts like 'graduation', 'differentiation', even 'reciprocity' are being invented or reinvented to blur the fundamental divide of wealth and poverty, between the industrialised elite of our one world and the rest of us relegated to third class status or worse". This chapter takes a more pragmatic approach to the discussion. While acknowledging that many in the South see differentiation as a way to dismantle the unity of the South, it tries to move the discussion further keeping in mind a clear and predictable system for all countries.
Dynamic, indicator-based classifications of countries have been undertaken, among others, by the World Bank (see Appendix A), which classifies countries on the basis of income per capita; UNCTAD (see Appendix B), which classifies countries to see if they fall into the category of LDCs; the Montreal Protocol on Substances that Deplete the Ozone Layer, which classifies countries on the basis of whether they produce more or less than 0.3 kg ozone depleting substances per capita; the Basel Convention on the Transboundary Movement of Hazardous Wastes; the Convention on Biological Diversity; and the Desertification Convention.

[19] See http://hdrstats.undp.org/indicators/1.html.

4.2.2 Graduation and differentiation applied to the climate regime

The climate change literature has also proposed or discussed the use of graduation (see, e.g. Berk and den Elzen, 2001; Gupta, 2003; Ott et al., 2004; Michaelowa et al., 2005). The proposals have in common that, increasingly, countries gradually take on commitments to limit or reduce their greenhouse gas emissions, that the level of these commitments gradually becomes more stringent, or a combination of both. The incremental move from one group of countries to another could be based on ad-hoc criteria, or on pre-defined rules for participation and differentiation (Berk and Den Elzen, 2001). The underlying rationale of these types of proposals is that 1) to achieve the ultimate objective of the UNFCCC it is eventually necessary that developing countries also take on some kind of commitment; and 2) that not all developing countries are at the same stage of economic development, and that further differentiation between developing countries is possible and desirable given their differences in, among others, level of economic development, per capita emissions, and capacity to reduce greenhouse gas emissions. There are other ways of further differentiation between countries in the climate regime, including using the groups already endorsed in the UNFCCC and the Kyoto Protocol (such as LDCs and small island states); and ad hoc differentiation, where countries voluntarily choose to take on different commitments. However, the key difference between these approaches and the abovementioned approach is the use of (objective) criteria and indicators for differentiation. However, it should be noted that even this approach would have arbitrary elements, due to the choice of particular indicators that may unfairly privilege/disadvantage certain countries.[20] To avoid the impression that 'divide and rule' differentiation is only imposed on the developing world, the same criteria for differentiation should equally be applied to Annex I countries.

The graduation literature in the context of climate change has proposed a wide range of indicators for differentiating between countries. These include the following:

Table 4.1 Proposed indicators for differentiation between countries (Karousakis et al., 2008).

Total GHG emissions	GDP per capita
Per capita emissions	HDI
Share of global emissions	Cumulative emissions
Proportion of world average per capita emissions	Climate vulnerability indicators
Emissions per GDP	Institutional/organisational indicators
Emissions growth rate	

In addition, other indicators, such as projected emissions, income distribution, mitigation potential, mitigation efforts, and mitigation costs and benefits could be used (Karousakis et al., 2008: 19).

A key principle in the climate change arena is the principle of common but differentiated responsibilities of countries and their respective capabilities. This principle points to the use of two main criteria – the notion of capacity and the notion of responsibility for anthropogenic climate change. The notion of capacity is related to the ability-to-pay principle; whereas the notion of responsibility relates to the polluter-pays principle (see, for example, Ringius et al., 2002). The viability of the indicators chosen for these criteria is influenced, among other factors, by data availability and comparability among countries (Karousakis et al., 2008). In that sense, GDP/GNP per capita and emissions per capita potentially present the best choice. Both are relative indicators, facilitating comparability. Furthermore, data on GDP/GNP is generally available for all countries. The World Bank, for example, collects these statistics on a regular basis. Emissions data is also available for all countries for 2004 (see, e.g., the

[20] For example, the GNI per capita of Equatorial Guinea (which statistics show is relatively high) would not reveal that the country is, in fact, an LDC, and has a relatively low HDI.

Climate Analysis Indicator Tool (CAIT) of the World Resources Institute21) or UNDP (2008). However, it should be noted that emissions data availability is better for CO_2 emissions than for all six GHGs and that emissions from Land-Use, Land-Use Change and Forestry (LULUCF) are still more difficult to estimate than those of other sectors. Given the data availability and comparability, it is hence not so surprising that the indicators CO_2 emissions (excluding LULUCF) and income per capita are the ones most commonly used in the differentiation literature (Karousakis et al., 2008).

We illustrate the possibilities and effects of various options for differentiation between countries in the CDM by using two indicators – GNI per capita in 2007 and CO_2 emissions in 2004. However, the following two caveats should be kept in mind.

First, selecting as few as two indicators to characterise a complex issue is one out of many options available for differentiation between countries. Furthermore, the indicator of emissions per capita does not account for the historical responsibility of countries for the problem of climate change, which is arguably an important factor in the context of the principle of common but differentiated responsibilities. However, the two indicators are attractive because of their simplicity and predictability. Composite indices including a number of the abovementioned indicators and using weighing systems could also be devised (Karousakis et al., 2008), but this will make such a system more complex to administer and less predictable. Including historical responsibility would also raise questions regarding the calculation of responsibility (e.g. from which year onwards are countries to be held responsible for their GHG emissions?).

Secondly focusing on CO_2 emissions only, and excluding LULUCF for the purposes of differentiation is a severe limitation. LULUCF emissions account for a large share of the overall emissions of some countries (for instance, Brazil and Indonesia). Furthermore, including only available emissions data will ignore changes that have occurred afterwards. For instance, choosing the year 2000 will not take into account the emissions growth after this date, which in some cases (e.g. China) would have quite a significant impact on the indicators.

4.3 Operationalising differentiation between countries in the CDM

Given the criteria and indicators suggested in Section 4.3, what could a scheme for differentiating between countries look like? Using the two indicators of income per capita and emissions per capita, it is possible to classify countries into different groups. Based on the choice for three thresholds for per capita income and two thresholds for emissions per capita, we arrive at a general classification of 12 groups. Figure 4.1 shows how selected countries would be classified based on these indicators.

[21] See http://cait.wri.org/. It should be noted that other emissions data sources are available. For example, the UNFCCC collects emissions data through the Parties' submissions of their National Communications. Other sources are also available, including the Carbon Dioxide Information Analysis Center (CDIAC); the International Energy Agency (IEA); and the Energy Information Administration of the US government.

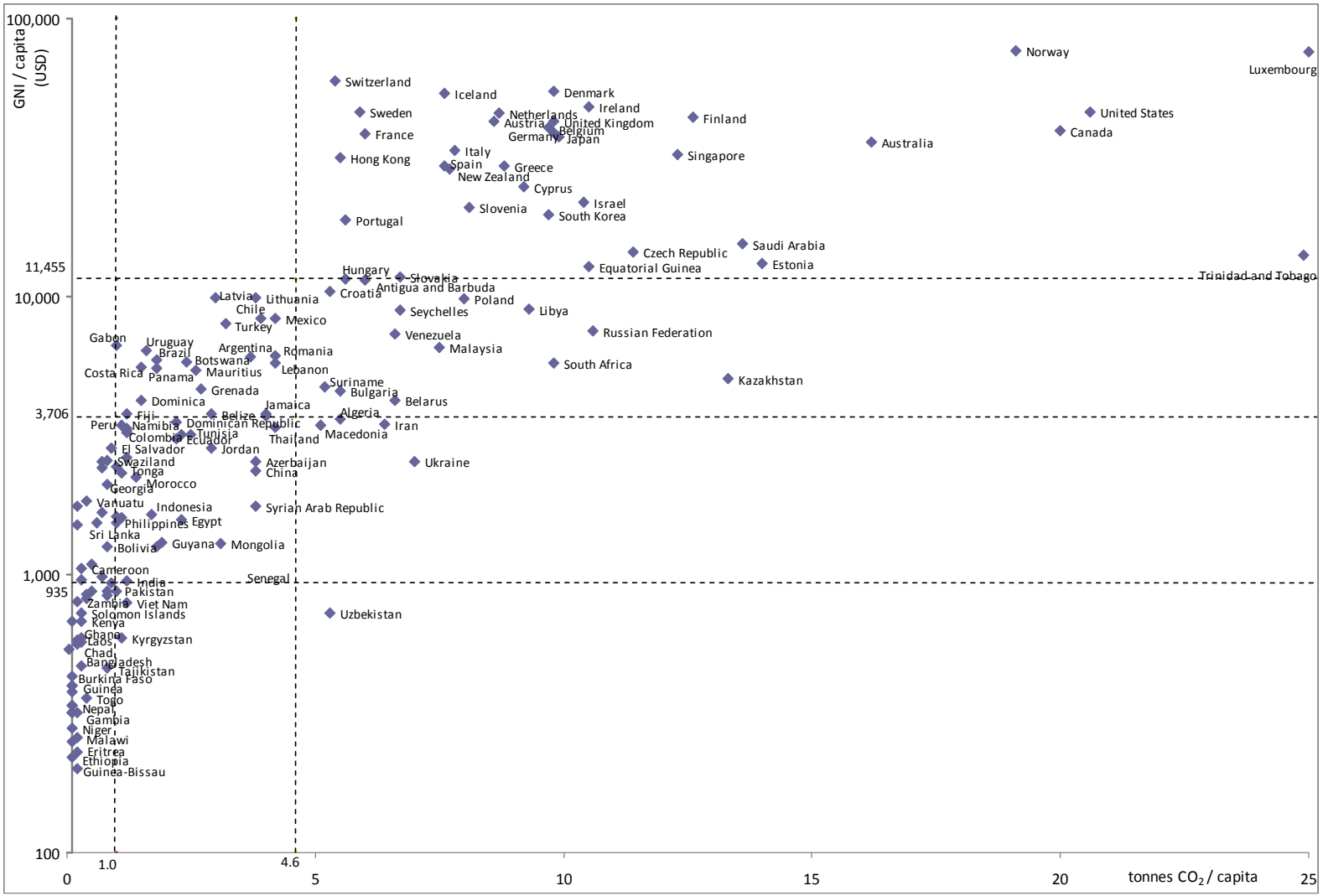

Figure 4.1 CO_2 emissions and GNI per capita of selected Annex I and non-Annex I countries

Countries would graduate into a different group as their income per capita and/or emissions per capita pass the threshold levels. A 'grace period' of a few years would grant countries graduating into a new group time to adjust their policies (Bodansky et al., 2004). For the income thresholds, we followed the World Bank classification that distinguishes between low income (US$935 or less); lower middle income (between US$936 and $3,705); upper middle income (between US$3,706 and $11,455); and high income ($11,456 or more).[22] For greenhouse gas or CO_2 emissions, there is no standard classification of 'low', 'medium', or 'high' emissions. We hence opted for illustrating this figure with two thresholds, the first one corresponding to the highest emissions by an LDC (Yemen; 1t); and the second corresponding to global per capita CO_2 emissions (excluding LULUCF) in 2004 (IPCC, 2007). There is hence a logic to the existing threshold levels in Figure 4.1, but these can be changed if there are reasons to do so.

An indicator-based system for graduation, it is possible to design specific policy packages for each group of countries with regard to their rights and obligations in the CDM (see Table 4.2 for an example). Arguably, negotiating different types of commitments for 12 different country groups would be quite a challenge, even if only for purposes of differentiation within the CDM. However, one could reduce the number of groups by using fewer thresholds (e.g. using two rather than three thresholds for income per capita, or only one threshold for emissions per capita). Furthermore, it is possible to negotiate different commitment types for two or more groups of countries (e.g. all countries that are above the highest income per capita threshold, irrespective of their emissions per capita; or all countries below the lowest emissions per capita threshold). It should be noted that differentiation between Parties for the purposes of the CDM does not necessarily have to lead to the creation of a new 'Annex', but could also be done on a more ad hoc basis, for example negotiations for individual countries, or through an opt-in approach.

Under a differentiation system, what could these policy packages look like? A number of considerations could be included in the operationalisation of the various differentiation options. We highlight a number of possible policy choices that can be made. First, as under the current rules, any country that ratifies the Kyoto Protocol (or its post-2012 successor) could be eligible to participate in the CDM. However, limitations could be introduced for countries that have a high per capita income, for which the argument can be made that given their capacity, they would be ineligible to host CDM projects, as they would be able to finance their own mitigation activities. All countries below the high income per capita threshold would thus in principle be eligible to host CDM projects.

Second, however, differentiation options could be implemented to steer CDM investments to countries that have been disadvantaged previously. Following Cosbey et al. (2006) we use the per capita CER generation as a measure for regional distribution. As shown in Annex D, a diverse picture emerges if we use the CDM project portfolio of early 2009. However it can be concluded that the LDCs are virtually absent from the first half of the country ranking. From this argumentation it follows that improving conditions for CDM in LDCs would benefit the regional distribution. There are, of course, valid counterarguments against such a policy choice. First, this may punish those countries that have been successful in attracting CDM projects. Second, this group includes countries with significant CDM potential. Third, even though the per capita income may be above the threshold, some countries have a significant population below poverty thresholds, which could benefit from the CDM. Nevertheless we assume that it is seen as desirable to provide additional incentives for CDM projects in countries with low per capita emissions and/or low per capita income in order to ensure a more equitable geographical distribution of CDM projects. These countries would include almost all LDCs. The question is then what differentiation options could be used to steer CDM investments towards other countries. Two differentiation options that aim to address the regional distribution between countries mentioned in Chapter 3 are the use of caps on CER issuance and discounting, which could be applied to the eligible countries in the middle income per capita and middle and high

[22] See http://go.worldbank.org/K2CKM78CC0. The World Bank thresholds have been chosen based on indicators including poverty incidence, infant mortality and GNI per capita. See http://go.worldbank.org/U9BK7IA1J0.

emissions per capita categories. To further enhance the capacity and increase the attractiveness of poorer countries and countries with low emissions, various ways of preferential treatment could be used for these countries. Furthermore, in combination with a discounting scheme for other countries, credits from countries with low per capita emissions could be multiplied. Table 4.2 summarises what the policy packages could look like for different groups of countries given these hypothetical policy choices.

Table 4.2 An illustration of differentiation between eligibility, quota, preferential treatment and discounting/multiplication between Parties

<table>
<tr><th></th><th>Emissions below minimum per capita</th><th>Emissions in the middle category</th><th>Emissions above maximum per capita</th></tr>
<tr><td>High income per capita</td><td colspan="3">Ineligible as host country</td></tr>
<tr><td>Upper middle income per capita</td><td>Eligible as host country</td><td colspan="2" rowspan="2">Eligible as host country, but caps on issuance/discounting may be applicable</td></tr>
<tr><td>Lower middle income per capita</td><td>Eligible as host country; preferential treatment</td></tr>
<tr><td>Low income per capita</td><td colspan="3">Eligible as host country; preferential treatment; possibly multiplication</td></tr>
</table>

4.4 Conclusions

This chapter examined the motivations for differentiating between countries under the CDM, and provided a first indication of how this could be operationalised.

The main messages from this Chapter can be summarised as follows. First, the Annex I/B-non Annex I/B distinction of the UNFCCC and the Kyoto Protocol is not based on clear criteria and does not accurately reflect differences in national circumstances. Furthermore, the classification is rather static, making it difficult to take into account changing circumstances. Second, there have been a number of proposals for (further) differentiation between Parties in the climate regime, based on a range of different criteria. Although all of these criteria could play a role in differentiating between Parties for the purposes of the CDM, we consider criteria related to income per capita and emissions per capita the most viable in terms of data availability, comparability, simplicity and predictability. However, other criteria could be taken into account to adjust country classifications for countries with special circumstances (e.g. countries vulnerable to climate change impacts). Third, based on these criteria, it is possible to devise a system under which Parties 'graduate' from one class into another, although it should be noted that differentiation between countries does not necessarily have to be implemented in combination with a system of graduation. Given the chosen classification, CDM 'policy packages' (i.e. rights and responsibilities under the CDM) could be assigned to groups of countries. These policy packages could put in practice one or more of the differentiation options described in Chapter 3. As an illustration, Table 4.2 showed how these different policy packages could be applied to different groups of Parties. Other classifications and 'policy packages' are also conceivable, based on different criteria and/or thresholds, but the illustration chosen in this chapter will be used for further analysis in Chapter 6.

5 Implementing differentiation: legal basis and implications for post-2012 CDM governance

5.1 Legal basis for differentiation

Pursuing differentiation between either Parties or project types must have a sound legal basis. In this regard, for any proposal for CDM reform it needs to be examined whether an amendment to the Kyoto Protocol – or perhaps even the UNFCCC – is required, or whether a COP/MOP decision would suffice (UNFCCC, 2008c). This section provides a preliminary analysis of the necessary legal basis for differentiation. It should be noted that this analysis mainly applies to the period up to 2012, as the continuation of the CDM and its shape and substance depends on an international climate agreement for the post-2012 period. However, the analysis also provides an indication what kind of legal text would be needed in a post-2012 climate treaty if differentiation for the purposes of the CDM would be part of such an agreement.

5.1.1 Differentiation between Parties

UNFCCC

As explained in Chapter 3, the Convention includes multiple provisions distinguishing between different types of countries. The Annex I and Annex II categories are linked to additional commitments (e.g. Art. 4.2 for Annex I countries and Art. 4.3 for Annex II countries). In addition, the Convention further differentiates between countries by mentioning the "specific needs and special situations of the least developed countries" (Art. 4.9) and by singling out countries particularly vulnerable to climate change impacts (see also Chapter 3). It could be argued that the broad Annex I/non-Annex I distinction is the Convention's main way of operationalising the principle of common but differentiated responsibilities and respective capabilities, and that there is no mandate in the UNFCCC for any further differentiation between non-Annex I countries. However, the Convention does not prohibit the introduction of new country categories, as long as there are no implications for countries' commitments under the UNFCCC. Introducing new commitments to non-Annex I countries, therefore, would require an amendment of the UNFCCC. However, none of the options discussed in Chapter 3 seem to add to the commitments of non-Annex I countries, and an amendment of the UNFCCC is thus likely not necessary.

Kyoto Protocol

Differentiation options for the CDM need to respect the provisions establishing the mechanism. Art. 12.2 stipulates that one of the CDM's objectives is "to assist Parties not included in Annex I in achieving sustainable development". In addition, Art. 12.3 states that "Parties not included in Annex I will benefit from project activities resulting in certified emission reductions". These provisions could be interpreted in two ways: 1) applying to *all* non-Annex I Parties; or 2) applying to *some or most* non-Annex I Parties. Under the first interpretation, excluding Parties from CDM eligibility would require a Protocol amendment, as the CDM would then not be able to help all non-Annex I countries in achieving sustainable development or benefit all countries. Under the second, broad interpretation, however, it would be allowed to deny some countries the benefits of the CDM. The Protocol remains ambiguous at this point, although it may be reasonable to assume that the CDM is intended to assist *all* non-Annex I Parties, as it does not specifically exclude some Parties. This seems to be the interpretation adhered to by UNFCCC (2009: para. 13(b)), which indicates that a Kyoto Protocol amendment would indeed be required. On the other hand, the Protocol does not establish the kind of project activities and type of benefits for non-Annex I Parties. Hence, it could thus also be argued that there already is sufficient discretion for differentiation under Art. 12.3.

Differentiation between countries in terms of eligibility to use CERs for compliance purposes would have consequences for Art. 3.12 of the Protocol, and would likely need an amendment (UNFCCC, 2009a).

Removing the additionality requirement altogether for some projects (through a positive list) would likely need amendment of Art. 12.5, which requires emissions to be "additional to any that would occur in the absence of the certified project activity". If this requirement is not met, the Protocol does not allow operational entities to certify the emission reductions. One should add, however, that while the Protocol is unequivocal in the need for baseline additionality, it does not specify the exact method with which to demonstrate additionality, and thus leaves room for more flexibility in the additionality test. Furthermore, the answer to this question depends on whether additionality is loosened in order to reduce costs for certain projects, or whether we apply a more flexible additionality test for certain project types in combination with a host country category because it can be reasonably assumed that these projects would not have taken place under business-as-usual. The latter would probably not require an amendment of the Protocol.

Awarding additional CERs to projects implemented in specific countries – multiplication with a factor greater than one – seems only possible when combined with discounting in other parts, in order to avoid a breach of Art. 12.2, which states that the CDM should contribute to the "ultimate objective of the Convention", and Art. 12.5, which indicates that projects need to provide "[r]eal, measurable, and long-term benefits related to the mitigation of climate change".

Summary
In sum, neither the UNFCCC nor the Kyoto Protocol explicitly mandates or explicitly prohibits differentiation between countries for the purposes of the CDM, as long as differentiation does not add to non-Annex I country commitments. This does not seem to be the case for the differentiation options discussed in Chapter 3. Some options for differentiation between Parties could in theory require amendments to the Protocol, because they: 1) do not result in global emission reductions; 2) do not respect the additionality requirement; or 3) have implications for Parties' ability to use CERs.

5.1.2 Differentiation between project types

UNFCCC
The Convention nowhere includes a preference for specific activities or technologies for reducing greenhouse gas emissions. Differentiation between project types is thus neither prohibited nor mandated in light of the UNFCCC provisions.

Kyoto Protocol
Like the UNFCCC, the Kyoto Protocol also does not include a stated preference for any kind of activity or technology reducing greenhouse gas emissions. However, the inclusion of the sustainable development objective in Art. 12.2 could be interpreted in the sense that projects that contribute more to this objective are to be preferred over projects that have a lower contribution. With the exclusion of nuclear energy and avoided deforestation from the CDM there has been precedent of this type of decision at COP/MOP level (see also UNFCCC, 2009).

As with the options for differentiation between Parties, some limitations may apply to certain differentiation options between project types. Thus, the options of awarding additional credits to certain project types or of removing the additionality requirement for certain project types are likely to require amendment of the Protocol.

Summary
Neither the UNFCCC nor Kyoto Protocol texts do not specify a preference for certain CDM project activities. However, the CDM's objective to contribute to sustainable development in non-Annex I countries could provide a rationale for differentiation. Still, differentiation options that increase global emissions or remove the additionality requirement seem to require an amendment of the Protocol.

5.2 Decision-making on differentiation

This section outlines the key issues on which decisions are required if the various options for CDM differentiation are to be implemented, as well as potentially appropriate levels for these decisions.

5.2.1 Differentiation between Parties

Differentiation between countries under the CDM would require decisions on a number of issues. Unless the eligibility of Parties is defined in a more static manner through annexes to a new climate agreement, specific eligibility criteria for Parties to participate in the CDM as host or investor countries would need to be defined (see Chapter 3). Furthermore, if the scheme incorporates a dynamic element of 'graduation' of Parties from one category to another, threshold values between the different categories would need to be determined, as well as the time span ('grace period') after which graduation becomes effective (or is reversed if a country falls below a threshold after passing it). Furthermore, review procedures for amending thresholds values if necessary would need to be defined (UNFCCC, 2008a).

Eligibility
Given the high political sensitivity associated with breaking up the preconceived categories of Annex I/B and non-Annex I/B countries under the international climate regime, a basic framework for differentiation between Parties under the CDM, and especially the criteria it would be based upon, would have to be endorsed at Treaty level (i.e. via an amendment to the Kyoto Protocol and subsequent ratification by its Parties). Graduation thresholds would most likely need to be adopted via a normal COP/MOP decision under the Kyoto Protocol (which would not require amendment of the Protocol)[23], whereas amendments of thresholds or further clarifications could possibly be delegated to the CDM EB.

In addition to the need for defining criteria and thresholds for differentiating between Parties as discussed above, the most important question under a system where host countries become ineligible to participate in the CDM once they pass certain thresholds relates to the alternatives for incentivising national mitigation activities. A plethora of approaches are theoretically possible. Countries could become subject to economy-wide or sectoral targets; implement domestic policies and measures; pledges; no-lose targets; etc. It is beyond the scope of this study to examine these in more detail. Suffice it to say that any system of differentiation between host countries on the basis of specific criteria needs to be part of a broader international agreement that provides for mitigation actions for different country groupings. Finally, one may assume that political reality will warrant a more subtle, less predefined framework for graduating out of the CDM.

Discounting/multiplication
The key decision to be made here is the determination of the discount (or multiplication) rate for CERs generated in different country groupings. Schatz (2008) suggests that discount rates should, among other factors, be based on the respective marginal abatement curves (MACs) of various greenhouses gases and production processes. Schneider (2008) on the other hand points out that the choice of the discount rate is necessarily arbitrary and a largely political decision. Both viewpoints imply that the discount (or multiplication) rate would need to be endorsed at a high level, i.e. through a decision by the COP/MOP. Given the political difficulty of reaching agreement on specific rates, less complex approaches (i.e. not more than one or two discounting/multiplication rates in total) should potentially be favoured.

Preferential treatment

[23] In the following, 'at COP/MOP level' will be used in this sense, i.e. a regular decision under the Kyoto Protocol that does not require ratification by Parties.

Any preferential treatment would need to be subject to periodic review to ensure its effectiveness. Also, like in the other options for differentiation between countries, criteria need to be established to identify the (groups of) countries that would receive the preferential treatment. The extent of preferential treatment could be decided through decisions of the COP/MOP (cf. decisions on small-scale projects). The details of implementation could however be delegated to the CDM EB.

Cap on issuance
Key decisions required when implementing a supply quota include the definition of the quota (UNFCCC, 2008a), for example in terms of number of projects or CERs per country, or through defining a specific market share. Apart from determining the threshold value of the quota, another issue that needs to be dealt with is updating the quotas periodically (UNFCCC, 2008a). On the level of decision-making, one could again assume that COP/MOP defines the principles, while leaving the detailed modalities, amendments and revisions to the CDM EB.

Allocated demand
What kinds of decisions are required for this option depends on whether the allocated demand is pursued unilaterally by CDM investor countries (in which case follow-up decisions under the UNFCCC are not required) or whether it is agreed internationally. In the latter case, a COP/MOP decision would probably be necessary, as allocated demand would constitute a rather far-reaching intervention into the investment or purchase decisions of Annex B parties planning to use CERs for compliance purposes.

5.2.2 Differentiation between project types

Positive/negative list
The main decision to implement positive and negative lists concerns the relatively straightforward, yet undoubtedly politically very charged question on which project types to include or excluded from these lists. Other issues relate to the possible establishment of a size threshold, or other specifications (e.g. the lists apply only to new projects of a certain project type). Given the precedent of the Marrakech Accords, a normal COP/MOP decision would likely be sufficient to establish the ex/inclusion of project types, whereas the details could be addressed by the CDM EB, possibly in conjunction with the Expert Group on Technology Transfer (EGTT).

Discounting/multiplication
A first question would be to which project types discount or multiplication rates would be applied. One option would be to link the rate to standards for sustainable development. As Bang and Gil (2005) propose: “If a project meets all [Gold Standard] criteria, 100% is granted. If it does not meet all criteria, but on aggregate is neutral or positive, it receives 80%. If a project does not meet [Gold Standard] criteria, but is still approved by DNA, it receives 60%.” Schneider (2008) argues that these decisions could be taken by a technical committee. The second question concerns choosing appropriate discount rate(s) or multiplication factor(s). In this regard, it should be noted that judgments on how much to discount or multiply for what type of projects would have a bearing on the revenues of a CDM project. Third, Parties would need to provide for possibilities to update the list of project types subject to discounting/multiplication, and to change the discount rate/multiplication factor when necessary (Schneider, 2008; UNFCCC, 2008a).

Minimum threshold for sustainable development benefits
A key question for this option is to establish the criteria to measure a project’s contribution to sustainable development with, a decision that so far has been delegated to host country DNAs. Given the sensitive nature of this decision, a COP/MOP decision would likely be required. However, once criteria have been agreed upon, other bodies, including the CDM EB and the Meth Panel could work out the methodology for assessing sustainable development impacts. The application of the methodology might then be assigned to DOEs as part of the validation process.

Preferential treatment
The kind of decisions required for preferential treatment for certain project types depends to a large extent on their character. Whereas endorsement at COP/MOP level may be needed in some instances, other – especially process-related – improvements (e.g. waiving the registration fee in some cases, or benchmarking, which has been endorsed already in the Marrakech Accords already) could potentially be decided by the CDM EB.

Cap on issuance
As for caps on issuance for certain host countries, the introduction of caps on issuance for project types would require decisions on the type of quota, the respective threshold values as well as review provisions. Again, the COP/MOP would be in charge of endorsing this option in principle, delegating the elaboration of the modalities to the CDM EB.

Allocated demand
Questions raised by the implementation of allocated demand requirements also include the determination of the basis for differentiation, and decisions on which project types to be included (UNFCCC, 2008a). Furthermore, the minimum quotas for preferred project types need to be established.

5.2.3 Overview

As discussed at the beginning of this chapter, especially options differentiating between the eligibility of Parties to host CDM projects are likely to require endorsement in principle at the treaty level, either through amendment of the existing treaties, or by direct inclusion in a new Protocol. If the objective of equitable regional distribution of CDM projects (currently only endorsed in the Marrakech Accords) is included in a new agreement, this should provide a sufficient basis for introducing other options for differentiating between Parties.

On the whole, decisions on differentiating between project types may be somewhat less politically charged than those differentiating between Parties, which may also have implications for the type of mandatory actions that they commit to undertake under a future climate treaty. However, a precedent of decisions on these issues at COP/MOP level exists for both types. As mentioned above, nuclear energy and avoided deforestation projects were explicitly excluded through a COP/MOP decision, whereas the COP/MOP endorsed preferential treatment for some country groups, such as the exemption from the adaptation levy for projects located in LDCs.

Overall, it appears that given the high political sensitivity associated with almost all of the options, most decisions may have to be adopted at the COP/MOP level, leaving little room for delegating decision-making to the CDM Executive Board (CDM EB) or other bodies under the UNFCCC or the Kyoto Protocol. However, it is also imaginable for the COP/MOP to only agree on general principles or criteria, and to leave it to the CDM EB to refine them further. Apart from involvement of the CDM EB and its subordinate body in preparing and adopting decisions, the UNFCCC Expert Group on Technology Transfer (EGTT) may be involved in an advisory role or other capacity (e.g. through the Handbook for Technology Needs Assessments for identifying low-carbon technologies in developing countries). The EGTT could support LDCs by assisting in the identification and selection of low-carbon technologies that contribute mostly to their development needs. Table 5.1 provides details for all the options.

Table 5.1 Decision-making on CDM differentiation options.

	Decisions needed	Appropriate level of decision-making
Differentiation between Parties		
Eligibility	- If a graduation scheme is chosen: criteria, 'graduation' thresholds and timeframes for 'graduation' review provisions transition rules	-Treaty level: criteria/country lists - COP/MOP[24]: graduation thresholds, transition rules, review provision, graduation timeframes
Discounting/ multiplication	- same as for 'eligibility' above - applicable discount/multiplication rate(s)	- If multiplication by > 1 is not compensated by equivalent discounting elsewhere, endorsement at treaty level appears necessary Otherwise COP/MOP
Preferential treatment	- same as for 'eligibility' above - type and extent of preferential treatment	- COP/MOP on questions of principle - CDM EB on detailed modalities
Caps on issuance	- same as for 'eligibility' above - type of quota (number of projects, of CERs, CERs/capita, specific market share, etc.) - threshold value	- COP/MOP on questions of principle - CDM EB on detailed modalities, amendments and revisions.
Allocated demand	-same as for 'eligibility' above - type of quota (certain shares for certain countries/regional groups or other) - threshold value	- COP/MOP on questions of principle - CDM EB on detailed modalities Annex I/B countries; EU; unilateral
Differentiation between project types		
Negative list	- project types to be excluded, possibly in combination with size thresholds and/or other specifications	- COP/MOP - CDM EB, possibly in conjunction with EGTT, on details
Positive list	- project types and size to which the removal of the additionality requirement applies	- depending on legal analysis, treaty level or COP/MOP - follow-up by CDM EB, possibly in conjunction with the EGTT
Discounting/ multiplication	- project types to which this applies applicable discount/ multiplication rates	- COP/MOP on both matters of principle and applicable discount rates (the latter might also be delegated to the CDM EB)
Minimum threshold for SD benefits	- criteria for minimum SD threshold - method for determining and monitoring whether it is being met - entity to verify the minimum SD threshold (CDM EB or DOEs or others)	- COP/MOP on principle and entity to verify the threshold - CDM EB and Meth Panel on details and assessment method
Preferential treatment	- e.g. determine ambitious benchmarks for energy efficiency in industry and GHG intensity of power production	- Depends on the kind of preferential treatment - generally, COP/MOP on principle; details by CDM EB/Meth Panel (yet not in the case of benchmarks, which are endorsed already in Marrakech Accords)
Caps on issuance	- type of quota (number of projects, of CERs, specific market share, etc.) - threshold value review provisions	- COP/MOP
Allocated demand	- type of quota (based on project type, project size, share of high quality projects) - threshold value - method/intervals for determining compliance with the allocated demand quotas	- - COP/MOP on principles - CDM EB on details alternatively: unilateral/regional initiative to self-impose allocated demand quotas

[24] COP/MOP refers to regular decisions under the Kyoto Protocol that do not require ratification by its Parties.

5.3 Implications for actors in the CDM

All options for differentiation, whether by Party or by project type, have some implications for CDM governance and for the various actors involved in the CDM project cycle. Table 5.2 discusses in more detail what the consequences of the various options would be for CDM management, and to which extent they would impact the responsibilities and workload of the bodies involved.

Quickly summarising the main findings, some of the differentiation options would initially increase the workload of the CDM EB, which would need to develop or adjust the relevant modalities and procedures. Whereas the imposition of a minimum threshold of SD benefits would arguably cause the heaviest increase in terms of workload and complexity (depending on how much of the review duties are administered by DOEs), other options, such as country (in)eligibility, positive lists, discounting, allocated demand) would have little to no implications.

The role of the UNFCCC Secretariat and its CDM division, which operates as the analytical and administrative back-up of the CDM EB and its subordinate bodies, would be especially critical in ensuring transparency (e.g. through a web interface) in the administration of all options that incorporate a dynamic element, i.e. where the eligibility status of Parties or project types is subject to change over time (e.g. graduation schemes, caps on issuance and allocated demand requirements). Furthermore, caps on issuance, allocated demand requirements and discounting/multiplication schemes may require adjustments of the international transaction log (ITL) and the registries, which the UNFCCC Secretariat would have to initiate/administer.

Moving to the implications for host country DNAs, the differentiation option that would have the most implications for them is undoubtedly the setting of an internationally determined threshold for sustainable development benefits. While this option would take away host countries' exclusive prerogative in this regard, they might still play a significant role in developing criteria and methodology to assess the sustainable development contribution of a project. Furthermore, DNAs in host countries benefiting from differentiation could, and in fact should, play a pivotal role in marketing their newly gained competitive edge, no matter whether differentiation in this case takes place by Party or whether the national CDM potential is particularly able to accommodate certain favoured project types.

Among all differentiation options, DOEs would in all likelihood also be most affected by the adoption of minimum standards for sustainable development benefits. The implementation of this option would largely complicate their tasks at the validation stage, by extending their review responsibility to incorporate not only the first objective of the CDM – reducing emissions – but also the second, their contribution of sustainable development, which is certainly less tangible and arguably much more difficult to ascertain.

Turning to the implications that operationalising differentiation under the CDM may have for project developers, it is important to note that, except for preferential treatment for certain countries or project types (including positive lists), which would effectively improve their situation in either financial or process terms, all other options rather complicate the CDM development and approval process from the participants' perspective. The most important factor to mention here is the increase in regulatory uncertainty resulting from the incorporation of more dynamic elements (graduation of countries, caps on issuance, allocated demand requirements) into the CDM. Project risks stemming from regulatory uncertainty is already now part of the reality of CDM project developers, but would increase significantly the more complex the adopted differentiation model is.

Table 5.2 Implications of CDM differentiation options for the key actors under the CDM.

	Potential implications for CDM actors				
Differen-tiation option	*CDM EB and subordinate bodies*	*UNFCCC Secretariat*	*Host country DNA*[25]	*DOEs*	*Project developers*
Differentiation between Parties					
Eligibility	Possibly adjustment of thresholds/redefinition of indicators, unless this is done at COP/MOP level.	Added workload (low) if a system with in-built graduation dynamics were to be adopted: monitoring of the eligibility status of countries based on changes in their national indicators. Keep developments with regard to graduation transparent, provide early 'warnings' if a country approaches an upwards or downwards threshold. In addition, monitor the effects of eligibility rules and report to COP/MOP.	Established national CDM infrastructures may become superfluous if a country becomes ineligible for CDM.	No impact.	No impact, if operated through annex to agreement. If graduation, largely increased project risk through a host country passing a threshold relatively unexpectedly and becoming ineligible for CDM.
Discounting/ multiplication	See "eligibility" above.	Added workload (low) in case of a 'perfect' graduation scheme – see "eligibility".	No impact.	No impact.	Impact on profitability of projects. If graduation, increased project risk due to potential CER losses if a country passes a threshold and a (higher) discount rate becomes applicable.
Preferential treatment	Initially increased workload (low) due to the need for elaborating sets of procedures based on the COP/MOP's political guidance. Later on, possibly reduced pressure through simpler procedures in some regards.	(Significant) costs and increased administrative workload for administering disbursement if upfront financing for project development, or more far-reaching waivers of registration fees are to be covered from UNFCCC funds.	Depending on the kind of preferential treatment, key role for host country DNAs to market the improved conditions and to publicise the specific support options available.	Possibly enhanced responsibility if project registration and issuance follow automatically from validation/verification, without review option for CDM EB.	All options for preferential treatments should improve conditions for CDM investment in the target countries, whether in financial terms or by lowering administrative hurdles.
Cap on issuance	Possibly review and adjustment of quotas, unless this is done at COP/MOP level.	Added workload (low) - monitor the eligibility status of countries based on CDM pipeline development. Keep trends towards cap on issuance transparent, provide early	No impact.	No impact.	Largely increased project risk as a host country may unexpectedly reach the limit of its cap on issuance and become ineligible to host projects.

[25] This column merely considers the changes for the role and responsibilities of host country DNAs resulting from different differentiation options. It does not discuss the impact of these options for host countries in general terms nor their impact on the geographical distribution of CDM projects.

	Potential implications for CDM actors				
Differen-tiation option	*CDM EB and subordinate bodies*	*UNFCCC Secretariat*	*Host country DNA*[25]	*DOEs*	*Project developers*
		'warnings' if a country approaches the quota limit. Monitor the effects of cap on issuance and report to COP/MOP.			
Allocated demand	Possibly review and adjustment of quotas, unless this is done at COP/MOP level.	Added workload (middle)– devise mechanisms to check (possibly via a revision of the International Transaction Log (ITL) or the CDM registry) whether Parties have adequately demonstrated compliance with the allocated demand requirements and report on this to CDM EB and COP/MOP.	No impact.	No impact.	Increased project risk (at least for unilateral projects) as demand for projects from certain countries/regions may drop if major buyers reach the limits of their allocated demand quota.
Differentiation between project types					
Negative list	No impact.	No impact.	No impact.	No impact.	No impact.
Positive list (removal of additionality requirement for certain project types).	If development of criteria or lists falls on them, increased workload (low). Otherwise, depending on the scale of positive-listed projects, reduced pressure due to easier project registration.	Depending on the scale of positive-listed projects, reduced workload for the UNFCCC Registration & Issuance Team.	No impact.	Depending on the scale of positive-listed projects, reduced workload due to easier project validation.	PDD development becomes easier.
Minimum threshold for SD benefits	Added workload (middle) due to the need for development and review of procedures for assessing SD benefits at the international level, and possibly an increasing number of cases for review.	Possibly added workload (middle) for UNFCCC Review Team if number of review cases increases as a consequence.	Reduced scope of work, but also less ability to steer national CDM development if assessment of SD benefits moves to the international level.	Added workload (high) and increased complexity of conducting validations if assessment of SD benefits becomes part of the process.	In many cases, PDD development likely to become more complex if SD benefits need to be documented in more detail according to a internationally defined format. Increased project risk, at least in the initial stages, given greater uncertainty at the validation stage.
Discounting/multiplication	Possibly review and adjustment of discount/multiplication rates, unless this is done at COP/MOP level.	Monitor the effects of discounting schemes and report to COP/MOP.	No impact.	No impact.	Increased regulatory uncertainty if discount rates are changed over time.

	Potential implications for CDM actors				
Differen-tiation option	*CDM EB and subordinate bodies*	*UNFCCC Secretariat*	*Host country DNA*[25]	*DOEs*	*Project developers*
Preferential treatment	If partial removal of additionality requirement, workload for both DOEs and CDM EB in project approval is reduced accordingly.	(Significant) cost increases and increased administrative workload for administering disbursement if upfront financing for project development, or more far-reaching waivers of registration fees are to be covered from UNFCCC funds.	Depending on the kind of preferential treatment, key role for DNAs of target countries in marketing the improved conditions and in publicising the specific support options available.	Possibly enhanced responsibility if project registration and issuance follow automatically from validation/verification, without review option for CDM EB.	All options for preferential treatments should improve conditions for project developers, whether in financial terms or by lowering administrative hurdles.
Cap on issuance	Possibly review and adjustment of quotas, unless this is done at COP/MOP level.	Added workload (middle) - devise mechanisms (e.g. via ITL or CDM registry) to monitor the eligibility of project types based on CDM pipeline development. Keep trends towards cap on issuances transparent, provide early 'warnings' if a project type approaches the quota limit.	No impact.	No impact.	Largely increased project risk if a project type unexpectedly reaches the quota limit and is unable to generate CERs.
Allocated demand	Possibly review and adjustment of quotas, unless this is done at COP/MOP level.	Added workload (middle)– devise mechanisms to check, possibly via revision of the International Transaction Log (ITL) or the CDM registry, whether Parties have adequately demonstrated compliance with the allocated demand requirements and report on this to CDM EB and COP/MOP whether Parties have adequately demonstrated compliance with the allocated demand requirements and report on this to CDM EB and COP/MOP.	No impact.	No impact.	Increased project risk (at least for unilateral projects) as demand for certain project types may drop if major buyers reach the limits of their allocated demand quota.

Finally, there might be issues related to the fungibility of CERs. Some of the options for differentiation by Parties or project types – notably issuance caps and allocated demand requirements – would de facto create different commodities, depending on the origin of the CERs or the project type from which they originated (e.g. LDC-CERs vs. non-LDC-CERs). The specific nature of CERs could be recognisable from their serial number. As a consequence, CERs would also have a different market value and be traded at different prices, a priori an effect intended by differentiation. However, this would also result in reduced fungibility of units in the market, i.e. a degree of fragmentation in the carbon market. Other differentiation options (e.g. discounting of credits, (in)eligibility to host projects) would not produce this effect, and as a consequence may be seen as less prone to market disruptions.

5.4 Conclusions

This chapter discussed some of the legal and institutional implications of the various options for operationalising differentiation under the CDM. Turning first to the need for a sound legal basis for differentiation, we find that *for most options there are no major barriers to Party or project type differentiation*. However, given the requirements of Article 12 of the Kyoto Protocol, differentiation should not lead to a net increase in global GHG emissions or lead to a removal of the additionality requirement. Extrapolating this to the possible shape and content of a future climate agreement, one can speculate that *differentiation between Parties would require an explicit endorsement of some sort in a future agreement*, either by listing Parties in different annexes, as in the case of the UNFCCC and the Kyoto Protocol, or by defining general criteria for differentiation for the purposes of the CDM. From a political feasibility perspective, the former option – annexes – is more likely to be chosen in practice, as countries may be very hesitant to commit themselves to a dynamic graduation scheme where shifts in indicators imply a change in rights and commitments and whose consequences they cannot oversee from the outset.

Moving on to the question of how differentiation could be implemented in practice, two conclusions stand out. First, given the high political saliency of most differentiation options, it seems that few of them could be initiated at a solely technical decision-making level, such as the CDM EB. Instead, the COP/MOP would in most cases need to endorse a specific option in principle (in cases of dynamic differentiation between Parties, it may have to define more detailed criteria and/or thresholds), while leaving further elaboration to the CDM EB and its subordinate bodies (if necessary). Second, whereas some of the decisions needed, such as the setting of minimum standards for the sustainability contribution of CDM projects, are far from straightforward and quite technical, others, in particular the determination of specific quotas, thresholds and discounting values necessarily incorporates an arbitrary, purely political element. On the other hand, a number of options, such as positive and negative lists, discounting or caps on issuance could be implemented relatively easily. Again, the politically most difficult decisions would likely concern options to differentiate between countries based on a set of pre-defined criteria.

All of the options for differentiation under the CDM will necessarily have implications on the CDM project cycle and the parties involved in it, from the UNFCCC Secretariat to DOEs and project developers. Most options would, besides from the initial extra work to elaborate modalities and procedures, not significantly increase the strain on the already very busy CDM Executive Board. Adjustments may rather affect the UNFCCC Secretariat as some of the options may require changes to CDM registries or the International Transaction Log. Host country DNAs and DOEs would mainly be concerned if CDM reform were to incorporate a stronger emphasis on the CDM's sustainable development benefits, i.e. by defining international minimum thresholds. Last but not least, except for the options relying on preferential treatment and positive lists, differentiation will probably not work in favour of project developers, except for those specialising in niche markets, such as LDCs or high quality projects. Especially if a dynamic differentiation scheme were implemented, either through graduation, caps on issuance or allocated demand requirements, regulatory uncertainty would increase significantly – whether the CDM market could balance this additional investment risk, remains to be seen.

6 Impacts on the carbon market

This chapter builds on the differentiation options discussed in Chapter 3. We analyse the impact of several possible differentiation options on the supply of carbon credits for host countries and technologies using the ECN CER supply curve. The options analysed here should be regarded as illustrative examples in a 'what-if' manner, which do not necessarily correspond to the preferred way forward.

6.1 Description of tool used

In this section we explain how the ECN marginal abatement cost (MAC) curve was developed. It is based on earlier ECN studies using bottom-up assessments of mitigation potential in developing countries (Wetzelaer et al., 2006; Bakker et al., 2007). It includes all major sectors, GHGs and technologies. For the CO_2 reduction options, the main data sources are detailed country abatement studies carried out between 1998 and 2006:

- Asia Least Cost GHG Abatement cost study; summary reports for 20 large non-Annex I countries;
- World Bank studies for national strategies for CDM;
- Studies by CCAP, TERI, Tsinghua University and Centro Clima on GHG mitigation scenarios and opportunities;
- UNEP GHG abatement costing studies.

Some of these studies only report the reduction potential for 2010. This was extrapolated to 2020 by applying a general growth factor for CO_2 emissions by world region based on the World Energy Outlook 2006. For some countries (representing approximately 20% of the GHG emissions non-Annex I countries) no detailed bottom up study could be found. For afforestation and reforestation Bakker et al. (2007) used an approach related to the potential for forest conservation.

Inclusion of non-CO_2 options in the MACs has mostly been performed by using data from an extensive study carried out by the US Environmental Protection Agency (USEPA, 2006). In addition bottom-up estimates of CO_2 capture and storage in power and industry (except natural gas processing) and LULUCF (afforestation, reforestation and avoided deforestation) were added. All abatement cost figures were expressed in US$ of 2006 price levels. See for a detailed methodology description Bakker et al. (2007).

In a recent update (see Appendix D) several elements were added:

- Data for sub-Saharan African countries based on a detailed bottom-up assessment of costs and potential of climate mitigation options (Gouvello et al, 2008).
- Inclusion of the costs and potential for CCS in natural gas processing, which is an important 'early opportunity' for CCS as CO_2 is already captured in the baseline scenario.
- New data for renewable energy and energy efficiency potentials from various sources for advanced developing countries.
- Update for the costs of avoided deforestation, based on a combination of three intermediate costs: (1) a compensation for living in a forest, in order for them to protect the nature; (2) a compensation for private forest property, as a payment for owners to discourage making profits by land use, as agriculture and pastures; and (3) funds for governments for them to monitoring the forest.

Some limitations of the approach of collecting bottom-up GHG abatement data to compile MAC curves for the non-Annex I region should be noted:

- The cost studies may not have covered all possible mitigation technologies: in particular the potentials for the buildings sector and renewables such as biomass, wind, hydro and geothermal are likely to be underestimated. McKinsey (2009) estimates a potential of 13

$GtCO_2$-eq/yr in 2020 for non-Annex I countries including LULUCF (using higher baseline emissions than we have done in this study). The overall abatement potentials by region for 2030 reported in the IPCC Fourth Assessment Report (IPCC, 2007) and Vattenfall (2007) are also significantly higher, which can only partly be explained by the longer time horizon. Therefore, even though the database underlying the MAC curves has been updated on several occasions, it cannot be considered as an exhaustive overview of mitigation options. This is especially true for renewable energy potentials. This strongly affects the total identified reduction potential. For example, for China the identified potential is 1.8 $GtCO_2$-eq/yr (based on CCAP/Tsinghua, 2006), which is significantly lower than some other recent studies (e.g Höhne et al, 2008).

- The baseline emissions against which the reduction potentials were estimated were reported on a sectoral basis, or sometimes not at all. The assumed baseline determines to a great extent the reduction potential, and may also change significantly over the years due to updated insights related to e.g. economic growth. The difference in potential for China, referred to above, may be explained to a great extent by the difference in baseline in the studies (i.e. CCAP/Tsinghua (2006) includes a relatively low baseline as well as a conservative estimate of the reduction potential).
- Different assumptions and approaches across abatement costing studies make it difficult to reconcile and combine results. In calculating GHG reduction potential and costs, studies make different assumptions about important parameters such as discount rates, fuel prices, global warming potentials, technology characteristics, etc. These assumptions strongly affect the calculated GHG savings potential and cost.
- The definition of costs was not consistent across studies. In general the abatement costing studies attempted to calculate the incremental costs of abatement options. However, different definitions of what is incremental (for instance barrier removal) were used by different studies. Economic benefits were excluded in some instances and apparently double-counted in others. Several studies noted that the cost calculations were preliminary, uncertain or qualitative.

The economic GHG abatement cost curves do not include non-financial barriers related to technology deployment or CDM regulations related to additionality. If these are taken into account a ‘market potential’ for CDM projects would be obtained, which could be substantially lower than the economic GHG reduction potential (Bakker et al, 2007).

Finally it needs to be considered that the bottom-up abatement cost studies are from 1998 to 2006. Oil prices were in the range of US$ 20-40 per barrel, which is significantly lower than the most recent projections in the World Energy Outlook 2007 ($62 in 2030 (IEA/OECD, 2007)). In a report focussing on European mitigation options, Bakker et al. (2009) show that the impact of higher energy prices on abatement cost of options that replace oil or natural gas might be substantial. Particularly mitigation options in the transport sector become significantly cheaper. Also energy efficiency in gas-based industry and buildings will be more attractive at higher oil prices. For options that reduce coal consumption the impact is likely to be much smaller or negligible. Fossil fuel switch from coal to gas becomes much more expensive.

For the purpose of this report – analysing the impact of differentiation options – the MAC is suitable. An advantage compared to other models is the level of technical detail: it includes over 1000 country-technology combinations.

6.2 General assumptions and remarks

Figure 6.1 shows the resulting overall MAC for currently eligible technologies, CCS and avoided deforestation.

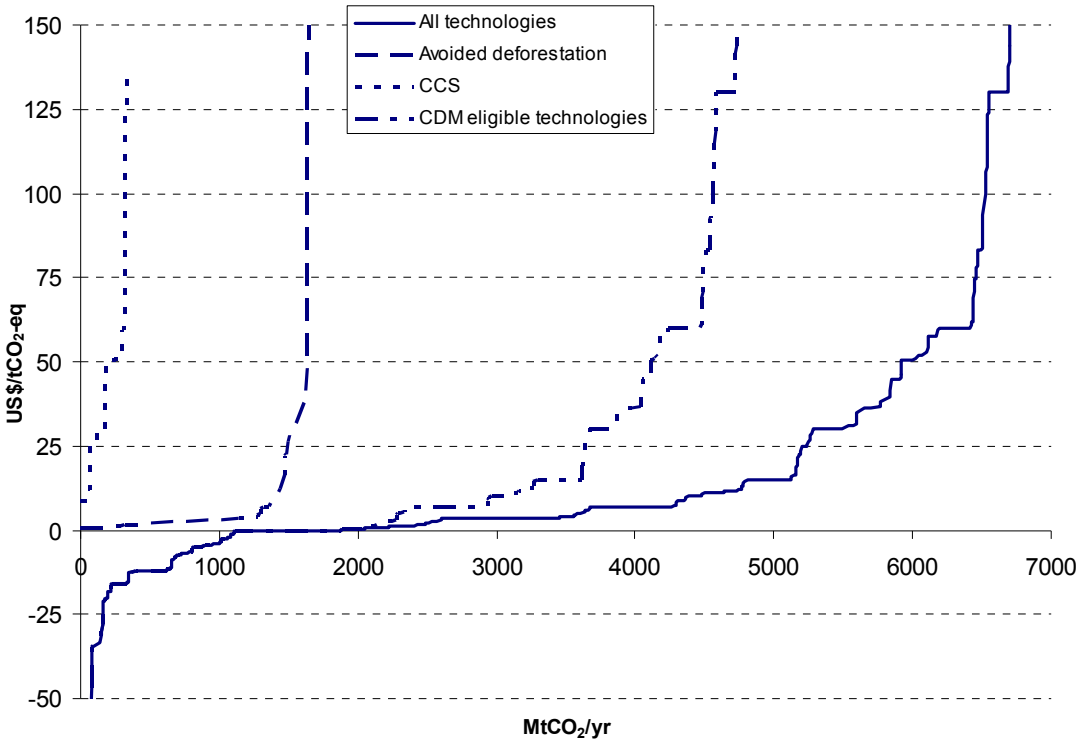

Figure 6.1 MACs for currently eligible technologies and new options

In the following analysis on the CDM differentiation options, we will use the curve of the CDM eligible technologies plus CCS and avoided deforestation. The substantial potential from avoided deforestation will increase the relative potential from particular host countries, namely LDCs, and its inclusion allows for a broader representation of the total GHG reduction potential. However, as it is still unclear whether this option will be included in the CDM the quantitative data presented should be treated with scrutiny. Nuclear energy, however, has not been included as this measure bears more controversy when linked to the CDM.

It should be noted that all results presented here are for the year 2020[26], which is an important mid-term time horizon and a reference year for commitments in the climate negotiations. The uncertainties related to supply and demand are already substantial for this time horizon, but would increase after this. However the longer term view also needs careful consideration, and conclusions and recommendations related to CDM differentiation may change if we would look at 2030 or 2050, e.g. due to more countries taking on mitigation commitments. For example Cabezas and Keohane (2008) argue that allowing REDD credits could be done without a substantial negative impact on the carbon market if banking of credits is allowed over the period from 2012 to 2050, as long as strong global emission limitations have been agreed up to 2050.

In addition, it should also be noted that the mitigation potential shown here is the technical potential at a certain cost level. This implies that no additional barriers have been taken into account, such as additionality requirements or split incentives for energy efficiency.

6.3 Impact of discounting: example

Before presenting the results of the credit supply analysis the concepts of multiplication and discounting must be defined. In this chapter we will only deal with supply-side discounting or multiplication, i.e. discounting implies that the CERs will be multiplied by a factor smaller than 1,

[26] The trends in the results may also be applicable to the period up to 2020, as the assumptions and country studies in the ECN MAC indicate a moderate increase in emission reduction potential between 2010 and 2020. After 2020 the uncertainties become larger.

while multiplication implies that the CERs are being multiplied by a number larger than 1. When it would be applied on the demand-side the effects on the carbon market are different.

In the following example the impact of discounting on the mitigation options will be illustrated in the cost curves as this may improve understanding of the credit supply dynamics. Multiplication or discounting of CERs will have an impact on both the potential and cost of generating CERs from implementing projects, even though the cost and potential for achieving GHG reduction will not change. This is explained in Figure 6.2, which shows an illustrative cost curve for four mitigation options. The continuous line represents the GHG abatement cost curve (i.e. with no discounting applied) and the dotted line represents the marginal CER generation cost curve in which mitigation options B and C are discounted by using a multiplication factor of 0.67 and mitigation options A and D are not discounted.

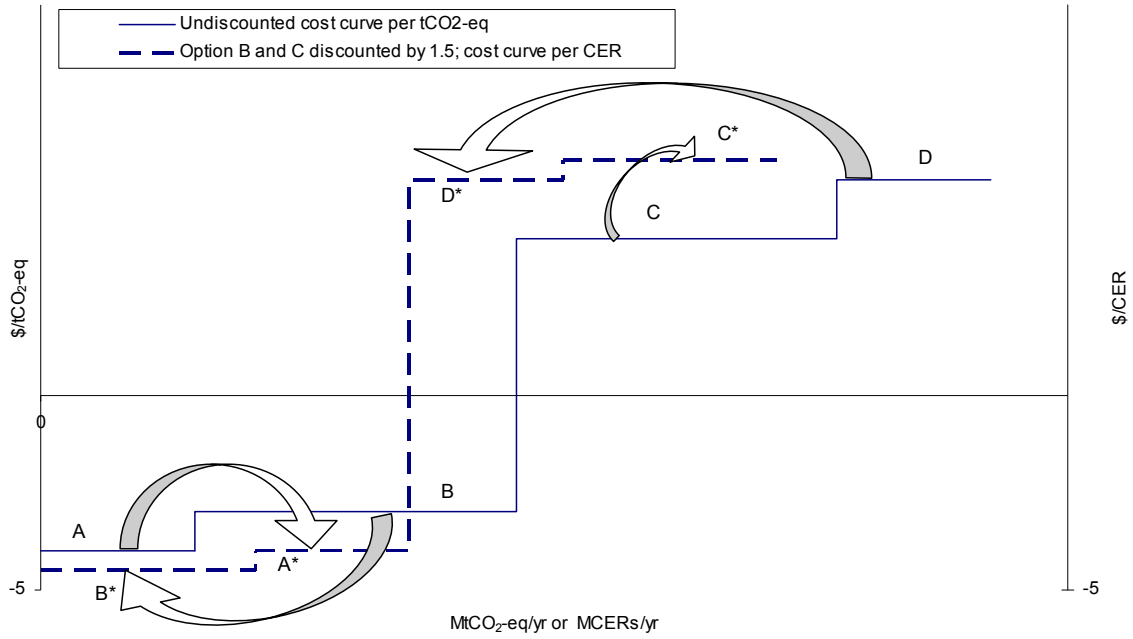

Figure 6.2 Impact of CER discounting on cost and potential of mitigation options

We can observe:

- The total potential for generating CERs is reduced, as well as the CER generation potential at a given cost level (e.g. up to zero $/CER).
- The merit order of the options has changed: option B is now the cheapest option rather A, and C the most expensive rather than D.

For multiplication of CERs the impacts will be opposite. In the following sections these two effects will be visible in the cost curves where the differentiation options of discounting and multiplication are applied to the cost curves.

6.4 Differentiation by Parties

Following the country differentiation explained in Table 4.3, Figure 6.3 shows the impact of different differentiation options in three steps. In the first step the high-income countries are not longer eligible to host CDM projects. These include South Korea, Saudi Arabia, Qatar and Singapore[27]. The next (thin continuous line) step shows what happens to the CER supply potential if CERs are discounted by multiplying the mitigation options by 0.75 for countries in group 5, 6, 8 and 9 (lower-higher middle income, medium to high emissions per capita). Note

[27] For Saudi Arabia, Qatar and Singapore however the coverage of the mitigation potential in the ECN MAC is particularly poor, as no bottom-up studies were found for these countries.

that in the case of CER discounting the x-axis represents (millions of) CERs rather than tonnes of GHG emission reductions: the emission reduction potential does not change, but the number of CERs generated does (as explained in 5.3). In the final step (dotted line) the GHG emission reductions from projects in LDC/SIDS are multiplied by a factor 1.5 when issuing CERs.

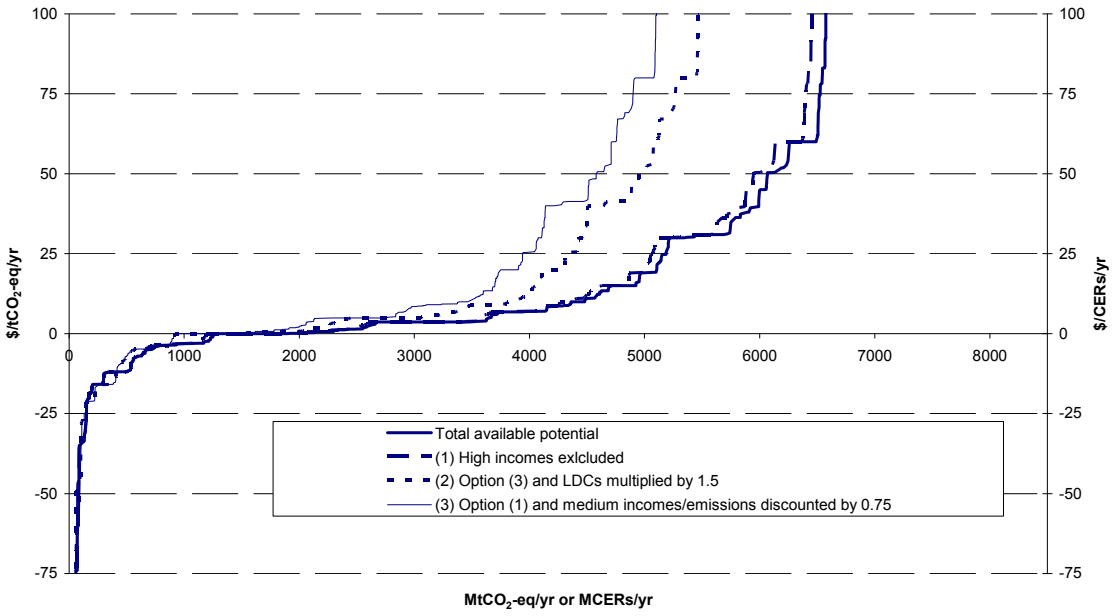

Figure 6.3 Multiplication of CERs to show the effects of differentiation between parties.

Figure 6.4 shows the MAC in case only LDCs and SIDS are eligible to host CDM projects. Obviously the GHG reduction potential is reduced substantially, however a significant potential remains, comparable to the annual GHG emission reduction achieved by the CDM projects in the pipeline as of January 2009 (UNEP/Risø, 2009). The dotted line shows the potential for credits in case a multiplication factor of 1.5 is applied to the emission reductions.

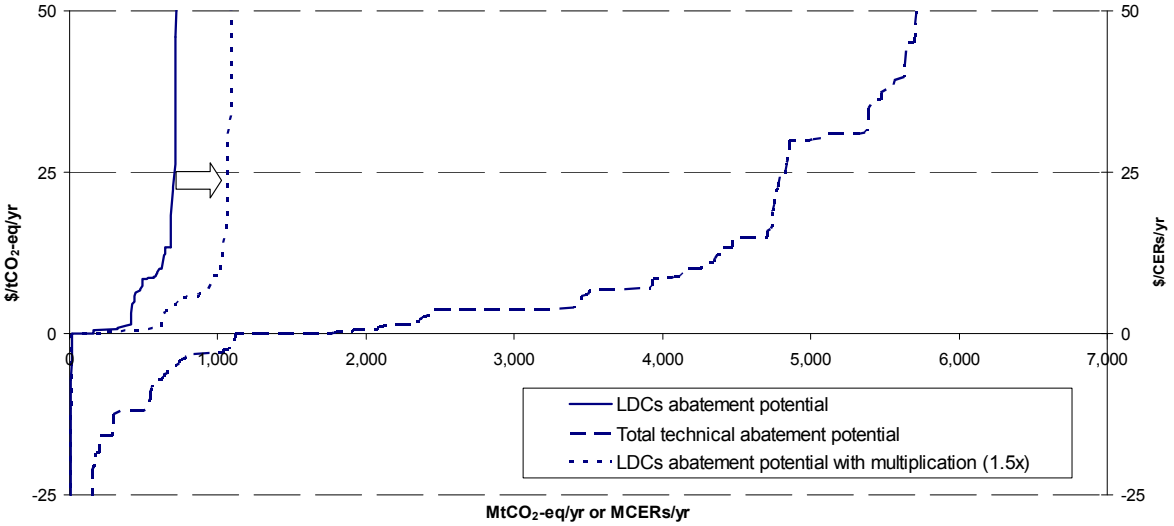

Figure 6.4 CER generation potential for LDCs/SIDS using a 1.5 multiplication factor.

Caveat: GHG abatement database may not be representative on country level (for some countries the total potential might be underestimated, or overestimated)

Another differentiation option could be to apply a maximum quota to the number CERs a country could supply to the carbon market. This could be done by applying a factor, e.g. 5%, to the historical GHG emissions (e.g. 2005) of the countries in the middle and higher income groups. This would have an impact on the potential for CERs, i.e. the cost curve will partly move to the left. This is not shown in this report. Similarly, certain portions of the demand for CERs could be allocated to specific host countries, which would likely increase their share in the global carbon market.

6.5 Differentiation by project types

For the purpose of the analysis in this chapter, and following the concerns given in Chapter 2 and the differentiation options given in Chapter 3, we give an illustration how differentiation between project types can be operationalised. First of all, there are concerns regarding possible negative impacts of the following technologies:

- Nuclear energy, which has been excluded from the CDM in the first commitment period due to issues related to risks and proliferation;
- CO_2 capture and storage (CCS), due to among others possible risks related to underground migration, seepage back to the atmosphere and the risk that investment in this technology could divert resources from renewable energy and energy efficiency (see, e.g., IPCC, 2005);
- Large hydro, which has been criticised because of their social and environmental impacts (World Commission on Dams, 2000).

Secondly, as highlighted in Chapter 2,, the sustainable development contribution of CDM projects widely differs (see, e.g., Sutter and Parreño, 2007), and those project types with particular high sustainable development benefits could be rewarded, or those with few or none could be treated differently. The CDM Gold standard only includes project types renewable energy and energy efficiency. Then there are projects with very low (or even negative) cost compared to today's CER revenues.

In summary, differentiation between project types can be based on a range of arguments, which sometimes lead to contradictory conclusions (e.g. renewable energy could be excluded due to questionable additionality or promoted because of contribution to sustainable development). For the purpose of this report we choose the following illustrative differentiation options:

- Negative list or discounting for CCS, HFC-23 and N_2O destruction and fugitive CH_4 reduction from fossil fuel production (based on low sustainable development contribution and/or high windfall profits[28]).
- Avoided deforestation (based on difficulty in determining baseline emissions and additionality, thereby raising concerns with regard to the environmental integrity).
- Only renewable energy and energy efficiency, or CER multiplication (based on the higher SD contribution compared to other project types, as used by the CDM Gold Standard).

In case only renewable energy and energy efficiency projects[29] would be eligible under the CDM still a substantial potential would remain at low cost. However a large part of this comes from the transport and buildings sectors, which has been shown difficult to harness, particularly under the CDM.

[28] According to the ECN MAC, HFC-23 and N_2O destruction options cost in the range of 0.3 -1 \$/tCO_2-eq while the cost range for fugitive CH_4 (from fossil fuel production and distribution) is rather large with the largest share from negative cost to 10\$/tCO_2-eq.

[29] This includes energy demand and supply side reduction, fossil fuel switch, waste gas utilisation and all renewable energy (i.e. all CO_2 reduction projects except CCS and LULUCF/REDD).

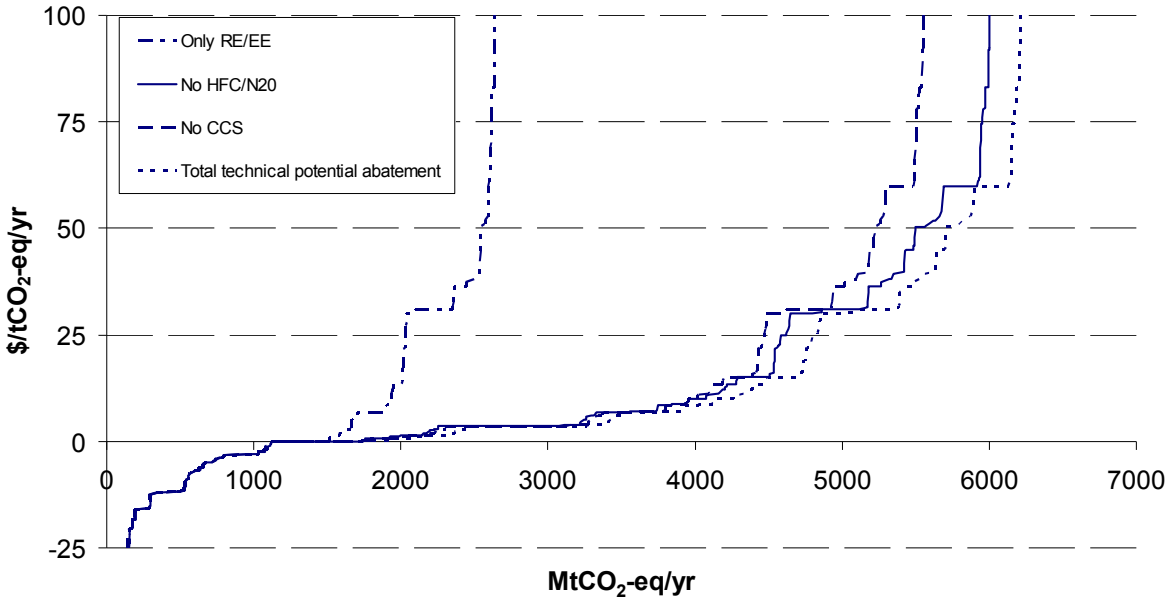

Figure 6.5 Impact of technology eligibility scenarios.

CER discounting can also be applied to project types. The following graphs illustrate this. Again, the horizontal axis should be read as millions CERs/yr, not GHG emission reduction. The thin continuous line shows the MAC without discounting. The most right-hand line shows the CERs from renewable energy and energy efficiency multiplied by a factor of 1.5, significantly increasing the CER supply potential. This increased supply could be compensated to some extent by discounting non-CO_2 projects such as industrial HFC/N_2O and fugitive CH_4 by applying a CER multiplication factor of 0.5. However, as the potential for the latter is small compared to the former this discounting is not likely to compensate for the increased CERs supply, thereby creating the danger of more CERs than GHG emission reductions.

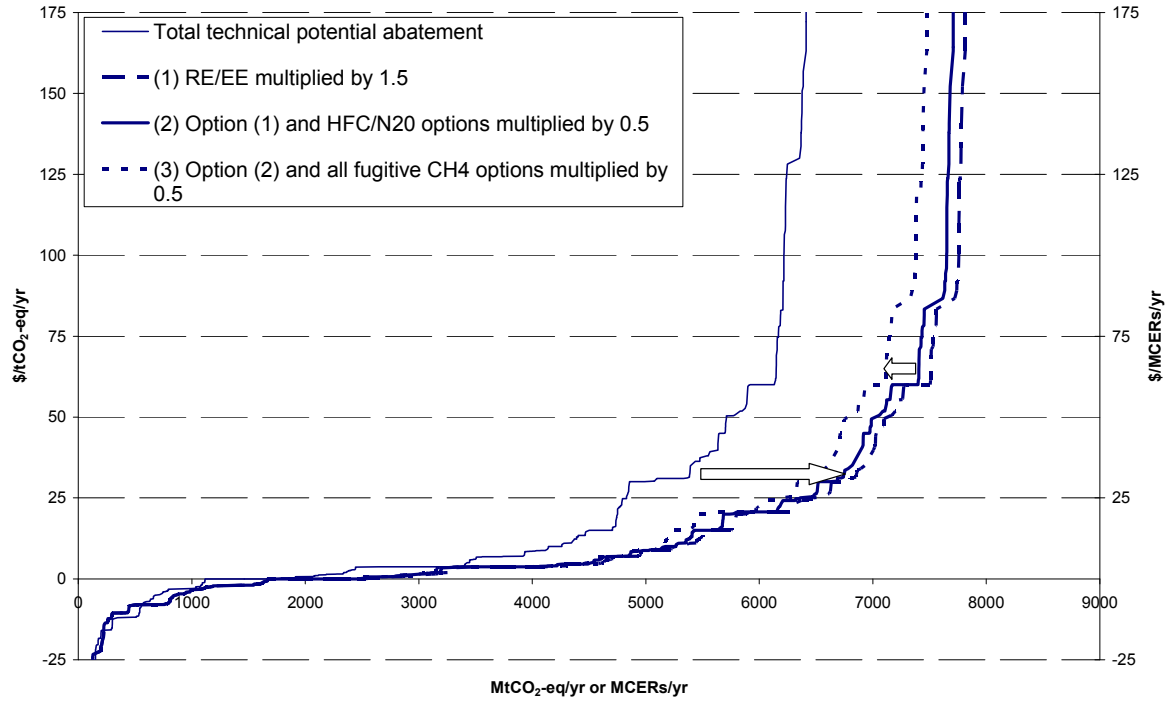

Figure 6.6 Impact of technology differentiation options.

6.6 Discussion

The examples of CDM differentiation options shown in this chapter may have a significant impact on the supply of CERs. The following inferences can be drawn:

- Including only LDCs/SIDS still leaves a substantial potential, but in case of high demand scenarios[30], this will not be sufficient to meet the demand. An option to increase this would be to differentiate this by multiplication, which will not only lead to a higher supply of CERs emanating from LDCs, but will also increase the profitability of projects in these countries. By this option, or allocated demand, LDCs could be provided with incentives to generate an amount of credits that are closer to their technical potential than is the case today.
- Multiplication and discounting of CERs has an impact on both the cost and the CER potential for project from technologies or countries to which the multiplication factor is applied. Multiplication by a factor > 1 may increase the profitability of projects. Discounting by 0.75 for middle income/medium-high emission per capita countries (i.e. most advanced developing countries) would leave enough potential to meet high CER demand scenarios.
- The exclusion of countries in the high-income bracket has a limited effect on the global carbon market.
- Applying multiplication factors may endanger the environmental integrity of the CDM. Therefore when considering multiplication factors it may be necessary to use these in such a fashion that the total potential for CERs is not larger than the GHG reductions from potential CDM projects. If the additional CERs this may create are compensated for by CER discounting for other countries or project types the environmental integrity of CDM could be maintained. As more projects emanate from the medium to high income countries, discounting these could still lead to an overall net reduction in GHG emissions through the CDM.
- The potential for RE/EE projects is significantly higher than that for high industrial HFC/N_2O gases and fugitive CH_4, thereby making it difficult to compensate for possible multiplication (which could lead to more CERs than emission reductions achieved). Discounting projects with low abatement costs (lower than the prevailing CER price) decreases 'windfall profits' for those projects. This can especially be seen in the case of projects related to high GWP gases (Figure 6.6).
- Exclusion of host countries of technologies could reduce the overall cost effectiveness of the system by reducing the total number of projects available in the market. However, the actual cost effectiveness impact depends on 1) whether the marginal options determine the CER price (which is currently not the case) and 2) whether the exclusion of options affects the marginal cost. In practice therefore the impact may not be significant. From the analysis in this chapter however no firm conclusions in this regard can be made.

[30] UNFCCC (2008) projects the CER demand in 2020 to be between 0.5 and 1.7 million.

7 Preliminary assessment of differentiation options

Chapter 5 sought to assess the implications that implementation of the various differentiation options might have on the CDM project cycle and the actors involved in it. Chapter 6 analysed their potential impact on the carbon market. In this chapter, we will take a somewhat broader view, and attempt to assess the options from a more comprehensive perspective. In Tables 7.1 and 7.2, we rank the options against a number of criteria and concerns. Evaluation scores range from '++' (contributes significantly to alleviating this concern/scores positively against this criterion) to '--' (significantly worsens this concern/scores negatively on this criterion). '0' means neutral/no impact, and '?' indicates difficulty to say something meaningful about the impact.

7.1 CDM governance and carbon markets

Table 7.1 builds on the analysis and the conclusions flowing from Chapters 5 and 6, arriving at four key criteria. The first, *'political feasibility'*, is informed by the analysis in Sections 5.1 and 5.2. We define political feasibility as the prospects for a particular option to gather sufficient support from Parties to be adopted and implemented. It is obviously difficult to judge this in isolation, without looking at the broader negotiation context, so our judgment remains necessarily speculative. The second criterion, *'ease of administration',* summarises findings of Section 5.3. It evaluates the implications of the options both on the workload of the bodies involved in the CDM project cycle and on the – administrative and intellectual – complexity of the tasks they are carrying out. The third criterion, *'impact on project developers*, also derives from Section 5.3. It assesses the effects of differentiation options on this actor group, both with regard to regulatory uncertainty and the complexities surrounding project development.

The last two criteria in Table 7.1 flow from Chapter 6. '*CER supply potential*' evaluates the changes in credit supply at a given abatement cost level. '*Market fragmentation*' relates to whether a particular option could result in creating different CDM 'sub-markets' with possibly different types of CERs, and different CER prices and limited fungibility of carbon credits as a consequence.

Table 7.1 Summary assessment: Impact of differentiation options on CDM governance and carbon markets.

	Political feasibility	Ease of administration	Impact on project developers	CER supply potential	Market fragmentation
Parties					
Eligibility	--	+	0	-	0
Multiplication/discounting	-	- to +	0	+/-	-
Preferential treatment	++	- to +	+	0	0
Cap on issuance	-	0	-	-	0
Allocated demand	-	-	-	0	-
Project types					
Negative list	-	+	0	-	0
Positive list	-	+	+	+	0
SD threshold	-	--	-	-	-
Multiplication/discounting	0	- to +	0	+/-	0
Preferential treatment	++	- to +	+	0	0
Cap on issuance	-	0	-	-	0
Allocated demand	+	-	-	0	-

7.1.1 Political feasibility

Although the political feasibility of differentiation options will in the first place depend on larger deals that may be struck in the context of the post-2012 negotiations,[31] some general remarks can be made. First, we would argue that any option that requires amendment of the climate treaties is less feasible than options that do not. Although most options do not seem to demand an amendment (see Chapter 5), this may be the case for options that would relax the additionality requirement, options that differentiate the eligibility of host countries, or options that would result in net increases in global GHG emissions.

Second, given the political sensitivities surrounding the debate on differentiation between Parties, it could be argued that this would be difficult to achieve. Still, some options for differentiation between Parties are already underway, and in particular the special position of LDCs has received recognition, both in the climate treaties and in the CDM discussions. Hence, some forms of preferential treatment of LDCs would likely be feasible.

Third, there is already precedent of some project type differentiation, for example through the exclusion of certain project types. However, the question is whether such a precedent means that the exclusion of other project types is also possible – this will much depend on the share of such project types in the portfolio of host countries, who would risk losing this share following the implementation of a negative list. Preferential treatment, again, seems to be the most feasible option for project type differentiation given the relatively minor impacts on the carbon market (see below) and precedent (e.g. modalities and procedures for small-scale projects).

Finally, options that can be implemented unilaterally are more feasible than options that require international agreement. In this regard, allocated demand could be implemented unilaterally by Annex I countries, which could decide to purchase a minimum amount of CERs from specific countries and/or project types. Furthermore, Annex I countries are also free to establish their own minimum threshold for sustainable development benefits (as is already the case for the EU ETS).

7.1.2 Ease of administration

The impacts of the various options for the work of CDM bodies including DOEs are likely to vary. Negative lists – once agreed politically – would be unproblematic to implement, and positive lists for project types would even reduce workload and complexity resulting from the additionality requirement. Discounting schemes with few discount rates may equally be easy to administer, but complexity would increase with an increasing number of discount rates and especially with a combination of multiplication (greater than 1) and discounting. The impact of preferential treatment options would depend on their focus: simpler procedures would result in reduced workload and complexity, whereas provision for upfront financing for instance would have the opposite effect. The option that would undoubtedly result in most administrative complexity is the imposition of minimum SD thresholds – both the elaboration of procedures and criteria and their application and review would likely be very cumbersome and controversial.

7.1.3 Impact on project participants

The only options that would effectively improve the situation of project developers are preferential treatment and the operation of positive lists. All others would have either no impact or increase regulatory uncertainty for the private actors operating in the CDM market. This is the case in particular with all differentiation schemes that incorporate dynamic elements, from party eligibility based on a graduation to allocated demand and cap-on-issuance type options. A minimum threshold for SD benefits would also complicate project development and increase regulatory uncertainty.

[31] For example, limiting the participation of countries in the CDM could be a prerequisite of US participation in a future climate treaty.

7.1.4 CER supply potential

As highlighted in Chapter 6, the potential supply for CERs will be reduced by most options, the extent to which depends on the actual application of the options. For instance, if important host countries are strongly capped on their CER issuance or apply heavy CER discounting the impact could be substantial. Preferential treatment or allocated demand has little or no impact on the total supply potential at a given cost level.
We note however that for some options, e.g. negative list, a complementary or alternative mechanism may be a new source of carbon credits (which is beyond the scope of this study).

7.1.5 Market fragmentation

Differentiation among Parties or project types may in some cases create different carbon commodities, e.g. in case CERs from LDCs are distinguished from CERs from other countries. This CER market fragmentation currently also exists to some extent with credits from afforestation and reforestation being 'temporary' or 'long-term' CERs which need to be renewed after a certain period. Some differentiation options could increase the number of CER types. This is most clear for allocated demand and caps on issuance (both for Parties and project types), as there will be a lower or upper limit to the amount of CERs that can be generated. Sustainable development thresholds may also result in different types of CERs, depending on how this option is applied (if there is simply one threshold for all projects to comply with there will be no increased fragmentation). The other options would not lead to market fragmentation, as they would simply provide improved conditions (e.g. positive list) but do not create different CER types.

7.2 Potential to address broader CDM concerns

Having thus summarised the key findings of chapters 5 and 6, in this section we will turn to discuss to which extent the various differentiation options introduced in this report may be able to address the broader concerns about the current functioning of the CDM. Assuming that we covered the aspect of deficits in CDM governance in Section 7.2 already (under the headings of 'ease of administration' and 'impact on project participants'), we will address five issues: environmental effectiveness (including environmental integrity and whether the system moves beyond offsetting), contribution of CDM projects to sustainable development, regional and sectoral distribution of projects, and the concern about high windfall profits. As for the analysis above, since little to no (quantitative) information is available for most of these, and since ex ante assessment of options, whose exact design and implementation is far from clear, is inherently very difficult, our assessment is necessarily preliminary and the conclusions drawn tentative. In addition it should be noted that the impact depends on the extent to which the option is applied (e.g. discounting by applying factor of 0.2 will have a larger impact than a factor of 0.8).

Table 7.2 Potential to address broader CDM concerns

	Environmental effectiveness	Sustainable development	Regional distribution	Sectoral distribution	Windfall profits
Parties					
Eligibility	0/+	?	++	?	0
Multiplication/discounting	++[32]	?	+	?	0
Preferential treatment	0	?	+	?	0
Cap on issuance	0/+	?	+	?	0
Allocated demand	0	+	++	?	0
Project types					
Negative list	0	0/+	-/+	0/+	++
Positive list	-	+	+	0/+	0
SD threshold	0	++	+	0/+	+
Multiplication/discounting	++	+	+	0/+	++
Preferential treatment	0	+	0	0/+	0
Cap on issuance	0	0/+	?	+	+
Allocated demand	0/+	+	?	++	0

7.2.1 Enhancing environmental effectiveness

Increasing the environmental integrity of the CDM or even moving the CDM 'beyond offsetting' to achieve net GHG reductions is a key rationale for CER discounting schemes. In addition, discounting may also be a way to deal with inherent uncertainty in establishing baselines and additionality. Therefore, this option scores highest on the criterion of environmental effectiveness. If CER issuance caps for certain host countries or (in)eligibility to host projects for countries were coupled with an incentive for them to provide an own contribution to mitigation (beyond the CDM's offsetting approach), it would also result in atmospheric benefits.

As regards project type differentiation, providing disincentives to projects with questionable additionality or difficulties in emission accounting by including them in a negative list or imposing a cap on issuance would equally improve the environmental integrity of the CDM. In contrast, implementing a positive list approach or specific incentives for projects with high sustainable development benefits could reduce the environmental integrity of the CDM in case they result in an increase in non-additional projects. However, Cosbey et al. (2006: 64) argue that, in the case of small-scale project activities, "the negative impact of any false positives under such a scheme might be less significant than the positive impacts of a streamlined process".

7.2.2 Contribution to sustainable development

Under the assumption of agreement on the sustainable development criteria (either internationally or nationally), the option that most directly seeks to improve the contribution to various aspects of sustainable development – and would thus in theory score highest – is the minimum threshold for sustainable development benefits.

For the other options, the extent to which the option contributes to sustainable development depends on the extent to which project types or (groups of) countries can be associated with higher quality projects. In terms of project types, one interpretation that finds some support in the literature (Sutter and Parreño, 2007; Holm Olsen and Fenhann, 2008) is that large-scale industrial gas projects (i.e. HFC-23 and N_2O) have a smaller contribution to sustainable development. This would mean that options clearly limiting the market share of these projects, such as a negative list or allocated demand, would provide a contribution to sustainable development. For other project types, the conclusion is less straightforward. For example, the interpretation that renewable energy projects have more sustainable development benefits (Pearson, 2005) has been nuanced by Holm Olsen and Fenhann (2008), who argue that not all renewable energy projects have a high contribution to sustainable development.

[32] Only for discounting.

In terms of Party differentiation, it could be argued that projects implemented in LDCs or SIDS could make an important contribution to sustainable development (e.g. Cosbey et al., 2006; Murphy et al., 2008), although this may be empirically difficult to ascertain. If this indeed were the case, options that clearly steer investments towards these countries, such as the ineligibility of other countries to participate in the CDM, allocated demand, or the multiplication of credits from projects implemented in LDCs and SIDS, could potentially improve the CDM's contribution to sustainable development. Caps on issuance, however, may lead to low quality CDM projects, "because project developers may be forced to cut corners in the face of increased costs caused by exhausted country quotas in countries where project implementation is cheaper" (Silayan, 2005: 53; see also Banuri and Gupta, 2000: 89).

7.2.3 Improving the regional distribution

Differentiation by Parties can directly influence the regional distribution of projects, in particular allocated demand, which requires a minimum amount of CERs in certain countries. Eligibility differentiation also holds potential to change the regional distribution, as excluding some countries leaves a greater share for eligible countries. However, a redirection of investments is not guaranteed – the market may also shrink (Murphy et al., 2008: 15). Preferential treatment would likely not have large results in large changes in the regional distribution. For example, it has been argued that differentiating the CDM levies in itself will not provide a substantial shift of investments from one country or region to another (Jung, 2006). Discounting or multiplication of CERs could improve conditions for currently underrepresented countries. However, as highlighted by Castro and Michaelowa (2009), this option on its own is not likely to result in more than a marginal improvement in the competitiveness of LDCs.

Differentiation by project type could indirectly influence the regional distribution. For instance, the exclusion of avoided deforestation may decrease options for LDCs, but the exclusion of HFCs could to some extent improve the regional balance, as most of these projects are now implemented in only a few countries.[33] Depending on which project types are distinguished and the future mitigation potential in different countries, differentiation options could alter the regional distribution. For a positive list, assuming that small-scale (renewable energy) projects would be on such a list, these are arguably more implemented in LDCs, at least in relative terms. The same goes for multiplication or discounting, assuming these would favour small-scale projects.

7.2.4 Improving the sectoral distribution

Improving the sectoral distribution of CDM projects towards the transport, buildings, agriculture and forestry sectors can only be achieved effectively by allocating a portion of demand to these sectors. Other options by project types, including discounting/multiplication, minimum SD thresholds, caps on issuance, and positive and negative lists, may improve the conditions for these sectors slightly compared to the other sectors, but the impact on sectoral distribution is not likely to be large. If these options are applied it is likely that (many) CDM projects in the energy supply and industry sectors will still be attractive, as they may not be included in the negative list and SD benefits can be shown. Therefore the currently underrepresented sectors will only have a small advantage compared to the current situation, and the sectoral distribution may not change significantly as a result of applying differentiation. In this regard, some authors have noted that the CDM in its current form, i.e. regardless of possible differentiation, is not well-suited for certain project types (see e.g. Sterk, 2008).

Differentiation by Parties may have some impact on the sectoral distribution of projects, but the extent of the impact is quite uncertain. In most countries the potential for mitigation in the energy supply, industry and waste sectors is large and therefore the sectoral distribution may stay as it is. On the other hand, it has been highlighted that small-scale energy efficiency projects in buildings, as well as forestry, may be relatively more important for certain countries

[33] However, it should be reminded that most of the potential for HFC destruction has been exploited, and further changes will only have a limited impact on the regional distribution.

compared to others, and therefore there could be a positive impact on sectoral distribution as well.

7.2.5 Reducing windfall profits

Windfall profits for low cost projects can most directly be reduced by excluding the relevant project types or setting caps on the issuance of credits. Furthermore, discounting these project types by a factor that reflects the marginal abatement costs compared to CER prices (Schatz, 2008) could significantly reduce the windfall profits made, although to some extent this effect could be offset due to a increased price of CERs that could be induced by applying discounting.

We assume that the other options do not have an impact on this aspect, as the other options (e.g. eligibility of host Parties) will change the conditions for these project types only marginally. Allowing only projects with high SD benefits would probably exclude those project types, thereby reducing windfall profits.

8 Conclusions and recommendations

Some of the main perceived problems of the CDM are:
- The questionable additionality of many projects;
- The 'offsetting-only' character of the CDM;
- Its relatively low contribution to sustainable development;
- An unequal regional distribution of CDM projects among non-Annex I host countries;
- The unequal distribution of projects among sectors;
- The existence of windfall profits for certain projects; and
- Transaction costs and intransparency related to its institutional and governance structure.

In order to address these issues, various options for differentiation in the CDM have been proposed by policymakers and academia. This report looked at two forms of differentiation in particular: 1) between Parties; and 2) between project types. Differentiation among Parties (both Annex I and non-Annex I) can be based on several criteria. In this report we showed what differentiation between countries could look like based on the criteria of 'responsibility' (CO_2 emission per capita) and 'capability' (GNI per capita). Differentiation between project types could be based on their (potential) impacts on sustainable development, use of certain technologies, the likelihood of additionality, and the risk of windfall profits (for non-CO_2 options).

From the analysis in this report we conclude:
- Preferential treatment for underrepresented host countries or preferable project types appears to be an option without significant negative impacts, but its contribution to improved regional distribution and sustainable development is likely to be limited. It can therefore be considered a 'no-lose' option, which is insufficient to significantly change the sectoral and regional distribution, but could still provide some support to countries and project types bypassed by the CDM so far.
- Thresholds for sustainable development set on an international level and verified by DOEs may improve the sustainable development profile of the CDM project portfolio. However, quantifying sustainable development benefits has been shown to be problematic, while these standards may not be politically feasible and are likely to be difficult to administer. In addition, it would be very difficult to define SD standards at the international level, since they would have to fit specific circumstances and development priorities of individual host countries.
- Differentiation based on quota or eligibility of Parties or technologies could significantly change the regional distribution of CDM projects. However, the CER supply potential will decrease and these options are likely to be politically difficult to negotiate. The supply of credits would likely be reduced, but would be sufficient to meet most 2020 demand scenarios.
- Discounting of CERs can contribute positively to most of the issues, in particular by creating a mechanism that results in global GHG emission reductions (if the discount rates are higher than the share of non-additional projects being registered in the system). Also the discount rates can be applied and adjusted such that underrepresented countries in the CDM market benefit, as well as technologies with strong contributions to sustainable development (if identified). The most important drawback is that it is likely to be difficult to negotiate the discount rates. On the market side, the option will have an impact on both the abatement cost and potential of mitigation options. Windfall profits may be reduced by application of CER discounting to appropriate technology types. Global supply of credits is likely to suffice to meet the demand (0.5-1.7 $GtCO_2$-eq/yr in 2020) for the discount factors applied in the illustrative analysis in this report (i.e. CER multiplication factor of 0.75 for medium income/medium-high emissions per capita countries; 0.5 for HFC-23, N_2O and fugitive methane projects).

Overall it can be concluded that there are clear trade-offs: the options that are most politically feasible have the smallest impact on the CDM's functioning as a market mechanism, but also

on sustainable development, and the geographical distribution of projects. In that regard, the various ways of preferential treatment are likely the easiest to implement. To find a balance between the CDM's different objectives, the middle-of-the-road options could be explored in more detail. Discounting could be explored, as it is an option that could be used in a gradual way. The most challenging option may be the explicit exclusion of countries from participation in the CDM. At the same time, this option would address the geographical imbalance most directly. Differentiation between project types could be more (politically) feasible than differentiation between Parties. If differentiation between Parties could be agreed upon in the framework of a new climate agreement, then it may be sensible to extend any country classification to the CDM.

Carbon market impacts could be significant for individual countries or technologies, for instance through a reduced potential for CER supply. However the CER supply is likely to be sufficient to meet projected demand. The overall cost-effectiveness could decrease somewhat, but discounting certain low-cost options may also increase cost-effectiveness. If multiplication would be applied to projects from certain host countries or technologies it needs to be balanced by discounting of other options in order not to create increases in global emissions. It therefore needs careful consideration. We show that the largest share of the potential emission reductions is in the realm of energy efficiency and renewable energy. In case CERs from these projects are multiplied it is not likely that this can be balanced by discounting of other options.

Policy recommendations:

- *Discussing differentiation options*: although differentiation options may be difficult to agree upon, they may be worthwhile discussing internationally given the need for finding solutions to address the various concerns about the CDM. This includes the use of discounting and eligibility of parties and technologies. The current negotiations in the AWG-KP already make a start in this regard, by discussing the advantages and drawbacks of various options mentioned in this report. However, given the importance of the design of a specific option, there is still room to discuss the options and their implications in more detail.
- *Continue preferential treatment*: Preferential treatment should be continued in order to support investments in countries and project types that have been bypassed by the CDM, even if only to a limited extent. Preferential treatment is already being implemented, for example, through the Nairobi Framework, which focuses on enhancing the share of sub-Saharan Africa in the CDM market.
- *Unilateral implementation*: In case no international agreement is reached on differentiation in the CDM, some options may still be implemented by countries. Notably, the use of a minimum threshold for sustainable development benefits, or allocating demand to specific countries or project types do not necessarily require an international approach.
- *Discussion of criteria:* Although the design and implementation of several differentiation options might be difficult to agree upon at the international level, there are clear rationales for differentiating between Parties and project types. At the very least, Parties to the UNFCCC and the Kyoto Protocol could discuss the reasons for differentiation, and where possible, discuss possible criteria for differentiating. These discussions should be informed by sound science and data regarding the economic and social circumstances of Parties, and the characteristics of certain project types.

Research recommendations:

Differentiation in the CDM has only received limited attention in the literature, although it could potentially address some of the concerns raised about the mechanism. Although this report sought to provide a first discussion of the possible options and impacts, a number of issues may be explored in more detail:

- *Criteria for differentiation between project types*: Whereas the general literature on differentiation between Parties has provided insights into the possibilities and limitations of criteria for country differentiation, possible criteria for differentiation between project types is less clear. In particular, it is unclear how to deal with project types that exhibit similarities (e.g. renewable energy), but at the same time also differences (e.g. in terms of additionality). Furthermore, it could be examined in more detail how various ways of differentiating

between project types (e.g. in terms of contribution to sustainable development vs technology used) compare.

- *Design implications*: The design details of several options (e.g. discounting/multiplication; preferential treatment) are still largely undetermined, but could have important implications. In particular, a more detailed assessment of the use of different discount factors in terms of market impacts could be useful.
- *Interaction with other CDM reform options*: This report has mainly addressed the differentiation options in isolation from other proposals for CDM reform. In practice, however, these options will likely interact, as they may seek to address the same concerns. For instance, how would the effectiveness of selected differentiation options in addressing concerns about the CDM be affected by a form of sectoral CDM? Furthermore, differentiation options that exclude certain project types or countries likely need to be accompanied by other mitigation actions. In this regard, how could differentiation in the CDM be related to the discussion on nationally appropriate mitigation actions, or what would be the possibilities to establish other funding mechanisms for projects that are excluded from the CDM?
- *Analysis of market impacts* of differentiated discount factors and other options provide a possibility for further investigation, e.g. for combinations of options mentioned in this report, REDD, or a combination with sectoral approaches. In particular the impact for individual host Parties and technologies need further attention. Also the impact of selected options (discounting, preferential treatment) on various actors in the CDM could be explored further.

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Appendix A World Bank Classification of Countries

The World Bank classifies countries into four categories: low income is < $935, lower middle income is $936 - $3,705; upper middle income is $3,706 - $11,455; and high income is $11,456 or more.

Table A.1 Low-income economies according to the World Bank

Afghanistan	*Haiti*	*Rwanda*
Bangladesh	*Kenya*	*São Tomé and Principe*
Benin	*Korea, Dem Rep.*	*Senegal*
Burkina Faso	*Kyrgyz Republic*	*Sierra Leone*
Burundi	*Lao PDR*	*Solomon Islands*
Cambodia	*Liberia*	*Somalia*
Central African Republic	*Madagascar*	*Tajikistan*
Chad	*Malawi*	*Tanzania*
Comoros	*Mali*	*Togo*
Congo, Dem. Rep	*Mauritania*	*Uganda*
Côte d'Ivoire	*Mozambique*	*Uzbekistan*
Eritrea	*Myanmar*	*Vietnam*
Ethiopia	*Nepal*	*Yemen, Rep.*
Gambia, The	*Niger*	*Zambia*
Ghana	*Nigeria*	*Zimbabwe*
Guinea	*Pakistan*	
Guinea-Bissau	*Papua New Guinea*	

Table A.2 Lower-middle income economies classified by the World Bank

Albania	Georgia	Namibia
Algeria	Guatemala	Nicaragua
Angola	Guyana	Paraguay
Armenia	Honduras	Peru
Azerbaijan	India	Philippines
Bhutan	Indonesia	Samoa
Bolivia	Iran, Islamic Rep.	Sri Lanka
Bosnia and Herzegovina	Iraq	Sudan
Cameroon	Jordan	Swaziland
Cape Verde	Kiribati	Syrian Arab Republic
China	Lesotho	Thailand
Colombia	Macedonia, FYR	Timor-Leste
Congo, Rep.	Maldives	Tonga
Djibouti	Marshall Islands	Tunisia
Dominican Republic	Micronesia, Fed. Sts.	Turkmenistan
Ecuador	Moldova	Ukraine
Egypt, Arab Rep.	Mongolia	Vanuatu
El Salvador	Morocco	West Bank and Gaza

Table A.3 Upper-middle income economies classified by the World Bank

American Samoa	Grenada	Poland
Argentina	Jamaica	Romania
Belarus	Kazakhstan	Russian Federation
Belize	Latvia	Serbia
Botswana	Lebanon	Seychelles
Brazil	Libya	South Africa
Bulgaria	Lithuania	St. Kitts and Nevis
Chile	Malaysia	St. Lucia
Costa Rica	Mauritius	St. Vincent and the Grenadines
Croatia	Mayotte	Suriname
Cuba	Mexico	Turkey
Dominica	Montenegro	Uruguay
Fiji	Palau	Venezuela, RB
Gabon	Panama	

Table A.4 Upper-high income economies classified by the World Bank

Andorra	French Polynesia	New Caledonia
Antigua and Barbuda	Germany	New Zealand
Aruba	Greece	Northern Mariana Islands
Australia	Greenland	Norway
Austria	Guam	Oman
Bahamas, The	Hong Kong, China	Portugal
Bahrain	Hungary	Puerto Rico
Barbados	Iceland	Qatar
Belgium	Ireland	San Marino
Bermuda	Isle of Man	Saudi Arabia
Brunei Darussalam	Israel	Singapore
Canada	Italy	Slovak Republic
Cayman Islands	Japan	Slovenia
Channel Islands	Korea, Rep.	Spain
Cyprus	Kuwait	Sweden
Czech Republic	Liechtenstein	Switzerland
Denmark	Luxembourg	Trinidad and Tobago
Estonia	Macao, China	United Arab Emirates
Equatorial Guinea	Malta	United Kingdom
Faeroe Islands	Monaco	United States
Finland	Netherlands	Virgin Islands (U.S.)
France	Netherlands Antilles	

Appendix B UNCTAD classification of LDCs

UNCTAD defines LDCs as shown in the table below. The UNCTAD list of LDCs does not entirely coincide with the World Bank list of poor countries, possibly because it has more criteria taken into account. For example, North Korea and Kyrgyzstan are to be found in the World Bank list but not the UNCTAD list.

Table B.1 Least developed countries according to UNCTAD

LDCs	LLDC	SIDS	LDCs	LLDC	SIDS
Afghanistan	Yes		Madagascar		
Angola			Malawi	Yes	
Bangladesh			Maldives		Yes
Benin			Mali	Yes	
Bhutan	Yes		Mauritania		
Burkina Faso	Yes		Mozambique		
Burundi	Yes		Myanmar		
Cambodia			Nepal	Yes	
Cape Verde		Yes	Niger	Yes	
Central African Republic	Yes		Rwanda	Yes	
Chad	Yes		Samoa		Yes
Comoros		Yes	Sao Tope and Principe		Yes
Congo			Senegal		
Djibouti			Sierra Leone		
Equatorial Guinea			Solomon Islands		Yes
Eritrea			Somalia		
Ethiopia	Yes		Sudan		
Gambia			Timor Leste		Yes
Guinea			Togo		
Guinea Bissau		Yes	Tuvalu		Yes
Haiti		Yes	Uganda	Yes	
Kiribati		Yes	UR Tanzania		
Laos, PR	Yes		Vanuatu		Yes
Lesotho	Yes		Yemen		
Liberia			Zambia	Yes	

Appendix C Emissions and income per capita

Country	2004 CO2 emissions per capita (tonnes)	2007 GNI per Capita Atlas
Albania	1.2	3290
Algeria	5.5	3620
Angola	0.7	2560
Antigua and Barbuda	6	11520
Argentina	3.7	6050
Armenia	1.2	2640
Australia	16.2	35960
Austria	8.6	42700
Azerbaijan	3.8	2550
Bangladesh	0.3	470
Belarus	6.6	4220
Belgium	9.7	40710
Belize	2.9	3800
Benin	0.3	570
Bhutan	0.2	1770
Bolivia	0.8	1260
Bosnia and	4	3790
Botswana	2.4	5840
Brazil	1.8	5910
Bulgaria	5.5	4590
Burkina Faso	0.1	430
Cameroon	0.3	1050
Canada	20	39420
Cape Verde	0.7	2430
Central African Republic	0.1	380
Chad	0.05	540
Chile	3.9	8350
China	3.8	2360
Colombia	1.2	3250
Comoros	0.1	680
Congo	1	1540
Costa Rica	1.5	5560
Croatia	5.3	10460
Cyprus	9.2	24940
Czech Republic	11.4	14450
Denmark	9.8	54910
Djibouti	0.5	1090
Dominica	1.5	4250
Dominican Republic	2.2	3550
Ecuador	2.2	3080
Egypt	2.3	1580
El Salvador	0.9	2850
Equatorial Guinea	10.5	12860
Eritrea	0.2	230
Estonia	14	13200
Ethiopia	0.1	220
Fiji	1.2	3800
Finland	12.6	44400
France	6	38500
Gabon	1	6670
Gambia	0.2	320
Georgia	0.8	2120
Germany	9.8	38860
Ghana	0.3	590
Greece	8.8	29630
Grenada	2.7	4670
Guatemala	1	2440
Guinea	0.1	400
Guinea-Bissau	0.2	200
Guyana	1.9	1300
Haiti	0.2	560
Honduras	1.1	1600
Hong Kong	5.5	31610
Hungary	5.6	11570
Iceland	7.6	54100
India	1.2	950
Indonesia	1.7	1650
Iran	6.4	3470
Ireland	10.5	48140
Israel	10.4	21900
Kazakhstan	13.3	5060
Kenya	0.3	680
Korea Rep.	9.7	19690
Kyrgyzstan	1.1	590
Lao PDR	0.2	580
Latvia	3	9930
Lebanon	4.2	5770
Libyan Arab Jamahiriya	9.3	9010
Lithuania	3.8	9920
Luxembourg	25	75880
Macedonia (TFYR)	5.1	3460
Madagascar	0.1	320
Malawi	0.1	250
Malaysia	7.5	6540
Maldives	2.5	3200
Mauritania	0.8	840
Mauritius	2.6	5450
Mexico	4.2	8340
Moldova	1.8	1260
Mongolia	3.1	1290
Morocco	1.4	2250
Mozambique	0.1	320
Namibia	1.2	3360
Nepal	0.1	340
Netherlands	8.7	45820
New Zealand	7.7	28780
Nicaragua	0.7	980
Niger	0.1	280
Nigeria	0.9	930
Norway	19.1	76450
Pakistan	0.8	870
Panama	1.8	5510
Papua New Guinea	0.4	850
Paraguay	0.7	1670
Peru	1.1	3450
Philippines	1	1620
Poland	8	9840
Portugal	5.6	18950
Qatar	79.3	52,240
Romania	4.2	6150
Russian Federation	10.6	7560
Rwanda	0.1	320
Sao Tome and Principe	0.5	870
Saudi Arabia	13.6	15440
Senegal	0.4	820
Seychelles	6.7	8960
Sierra Leone	0.2	260
Singapore	12.3	32470
Slovakia	6.7	11730
Slovenia	8.1	20960
Solomon Islands	0.3	730
South Africa	9.8	5760
Spain	7.6	29450
Sri Lanka	0.6	1540
Sudan	0.3	960
Suriname	5.2	4730
Swaziland	0.8	2580
Sweden	5.9	46060
Switzerland	5.4	59880
Syrian Arab Republic	3.8	1760
Tajikistan	0.8	460
Tanzania	0.1	400
Thailand	4.2	3400
Timor-Leste	0.2	1510
Togo	0.4	360
Tonga	1.1	2320
Trinidad and Tobago	24.9	14100
Tunisia	2.3	3200
Turkey	3.2	8020
Uganda	0.1	340
Ukraine	7	2550
United Arab Emirates	34.1	28,612
United Kingdom	9.8	42740
United States	20.6	46040

Sources: UNDP, 2008; Worldbank, 2008.

Appendix D CERs per capita

This appendix shows the number of CERs projected to be generated on average per year in 2008-2012 by CDM projected in the UNEP/Risø CDM pipeline as of March 2009, on a per capita basis. An asterisk in the second column indicates the country is a LDC.

	LDC	kCERs/yr	Population	CERs/capita/yr
Bhutan	*	3782	1	5.730
Qatar		2500	1	2.976
Panama		1786	3	0.541
Malaysia		13883	28	0.501
Israel		3602	7	0.493
Cyprus		382	1	0.484
Chile		7553	17	0.450
South Korea		16116	48	0.334
China		341085	1327	0.257
Mauritius		298	1	0.236
United Arab Emirates		831	4	0.189
Brazil		33004	188	0.176
Georgia		695	4	0.158
Jordan		843	6	0.143
Peru		4073	29	0.141
Argentina		5608	40	0.141
Mexico		14886	107	0.139
Ecuador		1879	14	0.135
Singapore		642	5	0.134
Nicaragua		640	6	0.114
Armenia		361	3	0.113
Guatemala		1433	13	0.107
Colombia		4755	45	0.107
Uruguay		350	3	0.106
Jamaica		284	3	0.105
South Africa		4899	48	0.102
Dominican Republic		997	10	0.102
Mongolia		251	3	0.097
Costa Rica		434	5	0.096
Honduras		653	7	0.092
El Salvador		634	7	0.092
Azerbaijan		785	9	0.091
India		99984	1141	0.088
Moldova		306	4	0.085
Thailand		4988	64	0.079
Bolivia		669	10	0.070
Tunisia		688	10	0.067
Guyana		45	1	0.060

	LDC	kCERs/yr	Population	CERs/capita/yr
Swaziland	*	64	1	0.056
Malta		20	0	0.049
Papua New Guinea		279	6	0.044
Cameroon		131	3	0.044
Indonesia		9935	229	0.043
Uzbekistan		1163	27	0.042
Egypt		3198	76	0.042
Macedonia		83	2	0.041
Cuba		465	11	0.041
Nigeria		5479	148	0.037
Cambodia	*	495	13	0.037
Vietnam		3021	87	0.035
Philippines		3035	91	0.034
Fiji		25	1	0.030
Sri Lanka		563	19	0.029
Kenya		825	38	0.022
Tanzania	*	776	41	0.019
Pakistan		3153	165	0.019
Senegal	*	220	12	0.018
Morocco		550	31	0.018
Paraguay		92	6	0.015
Kyrgyzstan		73	5	0.014
Mali	*	168	12	0.014
Zambia	*	150	12	0.013
Rwanda	*	19	2	0.009
Congo DR	*	579	63	0.009
Uganda	*	239	31	0.008
Tajikistan		51	7	0.008
Albania		23	3	0.007
Iran		463	71	0.007
Syria		128	20	0.006
Nepal	*	130	28	0.005
Madagascar	*	49	20	0.002
Mozambique	*	46	21	0.002
Bangladesh	*	235	159	0.001
Lao PDR	*	3	6	0.001
Ethiopia	*	29	79	0.000
Equatorial Guinea	*	0	9	0.000

Appendix E ECN MAC updates

This annex gives a detailed overview of the changes in the ECN MAC for non-Annex I countries since November 2007, when Bakker et al. (2007) was published.

1) Additional options
The most significant change is related to sub-Saharan African countries, for which the coverage of options was relatively weak until 2007. We updated the database by including the following options for sub-Saharan countries, based on a detailed bottom up assessment of cost and potential of climate mitigation options for 29 countries (Gouvello et al., 2008):

- Biomass for power generation
- Hydro power
- Fossil fuel switch in power production
- Energy efficiency in industry (steam optimisation)
- Biofuel based on Jatropha
- Bus rapid transit systems (BRT)
- Efficient lighting systems
- Gas flaring

Gouvello et al. (2008) give for each option a detailed assessment of investment and operating cost, baseline emission factors and in some cases benefits of the options, i.e. no abatement in $/tCO$_2$-eq are given. We had to calculate these ourselves, based on a 10% discount rate, 21 years economic lifetime. For the baseline power price we assumed a flat rate of $30/MWh. The abatement cost is then based on the difference between the cost of the abatement option and the reference option, divided by the difference in CO_2 emission factor. The abatement cost for fossil fuel switch in the power sector is assumed to be similar to figure found for Europe: $30/tCO$_2$-eq (Bakker et al., 2009). For BRT projects the cost was assumed to be similar to these found for BRT in China ($2.7/tCO$_2$).

Energy for nuclear facilities is currently not eligible under the CDM, but this option was added for consistency, based on the National Strategy Studies for CDM implementation for South Africa (World Bank, 2002) and Argentina (World Bank, 1999), and for India and China based on CCAP/TERI (2006) and CCAP/Tsinghua (2006) respectively. In the curves published in this report the options is however not included.

For the mitigation potential in the buildings sector in China we used Li (2008), which report a figure of 201 MtCO$_2$/yr (11% reduction compared to the baseline emissions) in 2020 based on the medium energy efficiency scenario from the National Development and Reform Commission. The abatement cost is based on Ürge-Vorsatz and Novikova (2008) who analyse abatement cost curves for the buildings sector for 10 countries in different world regions (not including China), and we conservatively assumed the abatement cost for China to be equal to the most expensive of these (-3 $/tCO$_2$)

CO_2 capture and storage in the natural gas processing sector may be an important 'early opportunity' for CCS as CO_2 is already captured in the baseline scenario. Until recently, data on this were hard to get by and estimates were based on top-down assumptions. We present here also a bottom-up analysis based on a database that was kindly made available by IHS, an oil and gas consultancy which owns a database of gas fields around the world, and their CO_2 contents. With the help of this database, we analyse the potential for GHG mitigation by CCS in the natural gas processing in more than 49 non-Annex I countries. The technical potential is estimated to be 146 – 222 MtCO$_2$ per year in 2020. Figure F.1 shows the break-down by country for the central estimate of 174 MtCO$_2$-eq/yr.

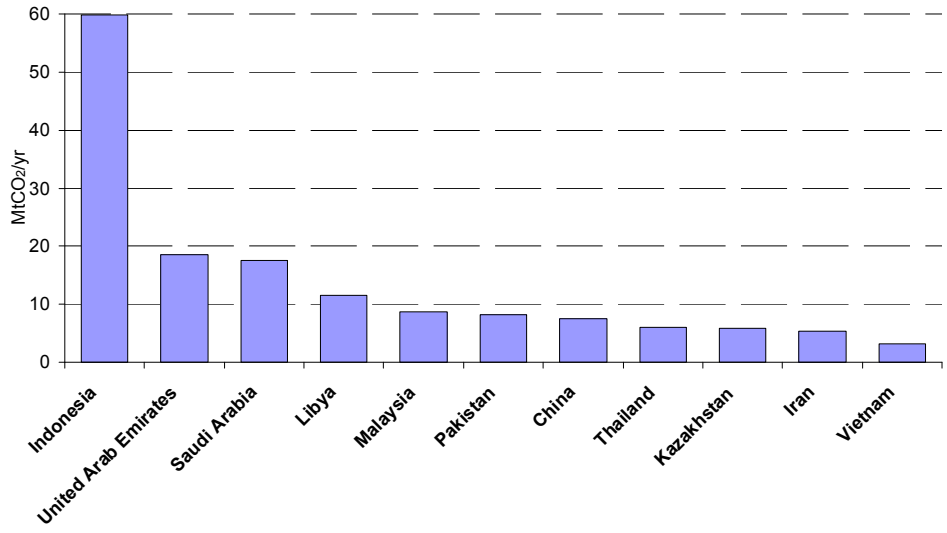

Figure E.1 Potential for CCS in the natural gas processing sector in 2020, mean values (De Coninck et al., 2009)

The abatement cost of these options (8-30 $/tCO$_2$) is based on Zakkour et al. (2008), who use a detailed bottom up methodology based on whether the CO_2 capture and storage takes place onshore or offshore and whether the processing installation is new-build or retrofit.

2) New cost calculation for avoided deforestation[34]

The potential for avoided deforestation has remained equal to that reported in Bakker et al. (2007)[35]. The methodology to estimate the cost of REDD has changed and is based on a study by IPAM (Environmental Research Institute of Amazonia, Nepstad et al., 2008) on Amazon forest, in Brazil. This REDD program estimates the cost to eliminate the deforestation in Brazil within ten years. They consider the total cost of avoiding deforestation as a combination of three intermediate costs: (1) a compensation for living in a forest, in order for to them to protect the nature; (2) a compensation for private forest property, as a payment for the owner to discourage making profits by land use, as agriculture and pastures; and (3) funds for governments for them to monitor the forest.

To compensate people living in forest IPAM's study proposes to pay half an official minimal wages for approximately 150 thousands households. For the land owners, an opportunity cost based on the profitability of soil production, pasture and sustainable wood production was estimated. For forest monitoring, the additional cost for government to protect and manage the public forest was estimated. There were no data available to reproduce IPAM's methodology. However, for each intermediate cost, it is possible to have good proxies. In the case of compensation for people living in a forest, instead of using minimum wages for each household, the GDP per capita could be used. We assume that an average household has four persons. As cost of opportunity, value of wood and non-wood forest products removals informed by FAO in its database could be used. A proxy for the cost of monitoring forest is harder to obtain, however it could be the cost per hectare estimated for Brazil in IPAM's study, which is 1.45 US$/ha. It is, in fact, an additional cost of monitoring. Table E.1 shows the updated cost (and potentials earlier reported) for the most important countries.

[34] Not included in the analysis in Chapter 6.

[35] This was based on an extrapolation of current deforestation rates reported by Forest Resource Assessment. It is projected that 81 million hectares of land will be deforested between 2012 and 2020, or 12 Mha per year, resulting in baseline emissions of 2.3 GtCO$_2$/yr in 2020.

Table E.1. Potential and cost of avoided deforestation in 2020 in ECN MAC

	Technical Potential ($MtCO_2/yr$)	Abatement cost ($US\$/tCO_2$)
Democratic Republic of the Congo	158	0.7
Zambia	60	1.2
Bolivia	72	1.4
Lao People's Democratic Republic	33	1.5
Brazil	815	3.7
Cameroon	38	3.7
Venezuela (Bolivarian Republic of)	101	4.0
Central African Republic	4	4.6
Madagascar	17	5.0
Congo	8	6.3
Papua New Guinea	13	6.7
United Republic of Tanzania	31	6.7
Paraguay	14	6.9
Nigeria	65	11.1
Ethiopia	15	12.2
Peru	27	16.2
Mozambique	5	18.4
Gabon	1	22.2
Angola	10	22.4
Sudan	10	26.3
Malaysia	33	31.2
Colombia	19	31.4
Indonesia	72	39.8
Argentina	14	54.1
Kazakhstan	4	81.5
Nepal	1	139.0
Myanmar	9	152.2
Mexico	25	163.2
Afghanistan	1	244.0

3) Adjustment factors for the mitigation potentials

In Wetzelaer et al. (2007) the potentials for each CO_2 reduction option were multiplied by 1.25, which aimed to extrapolate the findings of the approximately 20 country abatement studies to the rest of the non-Annex I region that was not covered. This resulted in an overall cost curve for the entire region. However for the current study we needed more detail on the regional or country level, and this factor was not deemed appropriate anymore and therefore deleted. This means that for a range of CO_2 reduction options the overall potential is likely to be underestimated, but not as much as a factor of 1.25, as for several countries (notably sub-Saharan Africa as mentioned before) new bottom up data was found.