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**EXPLORING OPTIONS FOR
“SECTORAL CREDITING MECHANISMS”**

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FOREWORD

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Executive Summary

Market-based greenhouse gas (GHG) abatement mechanisms are likely to remain attractive in a future climate regime, as they offer flexibility to reduce emissions where most cost-effective. There are different ways market-based mechanisms may be designed and implemented in different countries and/or sectors. The aim of this paper is to explore different ways of designing “sectoral crediting mechanisms” that could encourage greater GHG-friendly investments in given sectors by generating emission credits. This paper is part of ongoing analytical work on market-based approaches undertaken under the auspices of the Annex I Expert Group on the United Nations Framework Convention on Climate Change (UNFCCC).

A sectoral mechanism may be less cost-effective than a broad country-wide crediting mechanism, but there are several reasons why a sectoral focus may be appropriate in a future climate regime. It may be more feasible, from a policy, institutional and economic standpoint, for many countries to start on a sectoral basis, than to engage in a country-wide approach. Building technical capacity and developing and collecting the necessary data (for inventories and projections) may indeed be more manageable at a sectoral level (although it may be more difficult for some sectors, e.g. forestry, than others). Moreover, a few key sectors, e.g. electricity production and land-use change and forestry account for the majority of emissions in many countries. An international sectoral mechanism could also help address competitiveness concerns and mitigate leakage risks, as industrialised countries engage on more ambitious mitigation objectives. Further, a sectoral approach could provide an opportunity to promote investment in GHG-friendly technologies and further development/environment issues in some countries.

Sectoral crediting mechanisms (SCM) may be designed in different ways. Three potential designs of a sectoral crediting mechanism are examined in this paper:

- **Policy-based crediting**, where credits would be generated by adopting and implementing GHG-friendly policies in particular sectors;
- **Rate-based (indexed) crediting**, where GHG emissions below a certain intensity level (e.g. per product output or per value of output) would generate emission credits; and
- **Fixed sectoral emission limits**, where emissions “credits” could be generated if a sector or company emits at a lower level than an agreed, fixed, limit.

These three possible structures are assessed in terms of what is needed to define a baseline, how such mechanisms would generate credits and what their management/institutional requirements would be. These different design options for sectoral crediting mechanisms could operate on their own and/or with other GHG-mitigation measures. Also, the designs could be combined (e.g. a policy-based crediting mechanism with a rate-based baseline), as well as co-exist (e.g. one design could be applied to one sector, while another sector could be covered by another SCM design). Two distinct approaches could be envisioned for setting up sectoral mechanisms:

- **Trans-national sectoral mechanisms** – Such mechanisms would seek to encompass companies (or the majority of them) operating in a given sector world-wide. This wide reach would help to alleviate competitiveness concerns.
- **National sectoral mechanisms** – These would involve national governments proposing baselines for some of their sectors, as a means of providing incentives to exploit GHG-reducing opportunities by attracting GHG-friendly investments with sectoral emission credits.

Different sectors may not be equally suitable for different designs of sectoral crediting mechanisms. For example, domestically-oriented sectors such as buildings and private transportation may best be addressed by a mechanism where there is international agreement on a baseline methodology, but where the sectoral baseline level could vary by country to country to reflect e.g. national circumstances. Such a mechanism could be designed in fixed or relative terms, and could apply to sectors or policies. In contrast, options and implications of setting baseline levels at a trans-national level could usefully be explored for sectors producing widely-traded goods.

Historical data and emissions projections are needed to develop baselines for a sectoral crediting mechanism (unless these baselines are established on non-technical grounds). These requirements may in some sectors be greater than that needed for a project-based crediting mechanism. However, a broader sectoral crediting mechanism should lead to economies of scale and have the potential to lead to larger volumes of GHG reductions compared to a mechanism functioning on a project-by-project basis.

The environmental effectiveness of a sectoral crediting mechanism will depend heavily on its design¹. Any sectoral crediting mechanism with environmentally ambitious baselines may have a positive environmental effect if it attracts greater participation and GHG mitigation compared to the current Kyoto Protocol regime. There is likely to be some correlation between the level of participation in a sectoral crediting mechanism and the stringency of the baseline. It will also be important to limit the risk of free-riding, which could be significant in the electricity sector if *existing* zero-emitting sources (i.e. existing electricity generation from renewable energies/nuclear) can generate credits from a sectoral crediting mechanism.

Some level of international coordination and national management would be needed for any of the sectoral crediting mechanism structures examined in this paper. This would be needed both *ex ante*, i.e. to establish the form and scope of a mechanism, as well as *ex post* – to monitor and evaluate progress. Governments would remain responsible for ensuring compliance under sectoral crediting mechanisms implemented in their countries.

There are administrative costs associated with the development, implementation and enforcement of any policy instrument; sectoral crediting mechanisms would be no exception. The costs of establishing and implementing different sectoral crediting mechanisms will vary according to the mechanism type, its characteristics (e.g. whether or not it is binding), sector and number of participants. Allowing for different countries' national circumstances when negotiating any future mechanism/baseline/target is appropriate, but is likely to increase the up-front negotiation costs. It may therefore be more efficient to focus on a few "promising" sectors. This flexibility to incorporate national circumstances should result in more adequate/accurate baseline levels, but could add complexity to a negotiation. Participation and baseline stringency issues will be key in the design of any future sectoral crediting mechanism and in ensuring the mechanism's contribution to the effectiveness of climate change mitigation – in terms of costs and GHG reductions.

More detailed analysis would be needed to better understand the implementation issues arising from the different options for a sectoral-crediting mechanism in various sectors. Such analysis could be performed on one or more of several different aspects, including issues related to the design, environmental effectiveness, applicability, or political feasibility of establishing and implementing a particular type of sectoral crediting mechanism; exploring how a sectoral crediting mechanism would work at the transnational level, or in specific sectors.

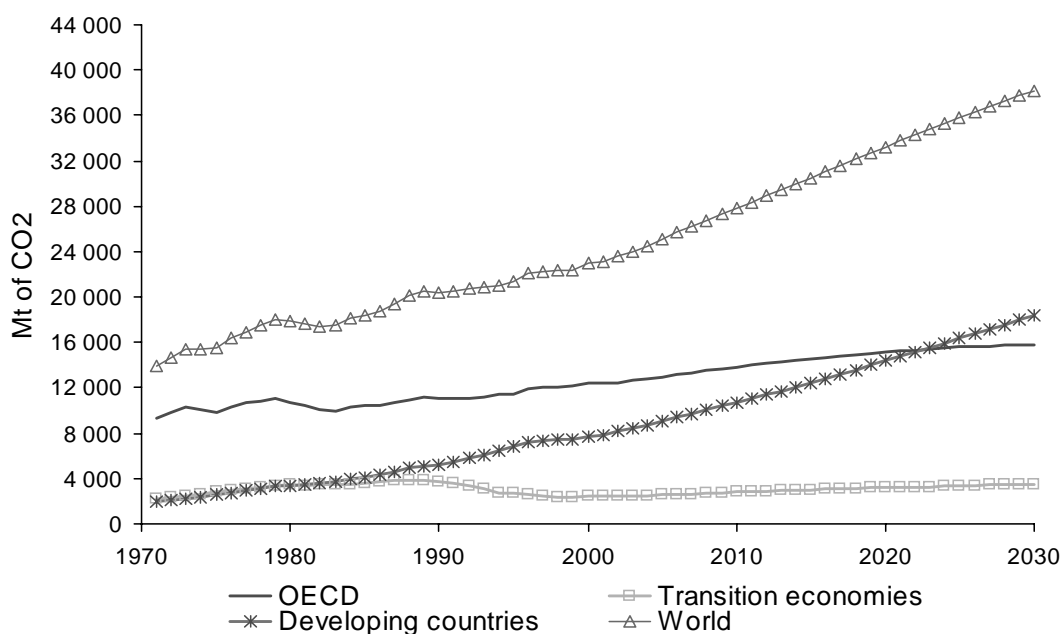
¹ It should be noted that "environmental effectiveness" is different from "certainty of GHG reductions". The latter refers to the extent to which fixed emission levels (or reductions) are predictable in advance.

1. Introduction

Conclusions and findings from the Intergovernmental Panel on Climate Change (IPCC) confirm a warming trend that is likely to be the result of human activity (IPCC 2001). Meeting the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) of stabilising concentrations of greenhouse gases (GHG) in the atmosphere requires significant GHG emission reductions compared to projected business-as-usual (BAU) trends, currently on an upward trend.

According to the IEA's 2004 World Energy Outlook's Reference Scenario² (IEA 2004b), energy-related CO₂ emissions – which account for the largest share of global GHG emissions – will be more than 60% higher in 2030 than in 2002 if no additional measures are taken (see Figure 1). This increase in emissions – of which over two thirds is expected to come from developing countries – would match the increase in world primary energy demand. In fact, energy-related CO₂ emissions are projected to grow slightly faster than energy use.

**Figure 1: IEA Projections of Energy-Related CO₂ Emissions by Region
(Reference Scenario)**



Source: IEA (2004b)

The IPCC notes that responses to climate change can be more cost effective if deployed as portfolio of policy instruments. However, it highlights that “market-based instruments may be cost-effective in many cases” and that “the effectiveness of climate change mitigation can be enhanced when climate policies are integrated with the non-climate objectives of national and sectoral policy development” (IPCC 2001).

² The Reference Scenario takes into account government policies and measures that had been adopted by mid-2004.

This paper seeks to explore different ways to design “sectoral crediting mechanisms” to encourage greater GHG-friendly investments in given sectors through emission credits. These are defined here in a broad sense, i.e. including emissions credits and allowances. Through a sectoral crediting mechanism, policies and/or investments leading to emission mitigation in a given sector could earn emission credits. These credits could in turn be traded in a carbon market and used to offset GHG commitments. Alternatively, they could be banked by host countries for future commitments. This paper provides an overview of the key issues arising from different sectoral crediting options, and then proposes avenues for further work to better understand the implications of different options. The paper does not seek to rank options, nor does it undertake an in-depth analysis of implementation issues.

A sectoral crediting mechanism could be structured in different ways. For example, it may be designed to encourage GHG friendly investments in certain sectors, or to encourage GHG-friendly policies by governments. The sectoral baseline may be based on a fixed emission limit, or on an indexed basis. The types of incentives or obligations that such mechanisms create would depend on whether the sectoral baseline against which performance is compared is binding or non-binding. Sectoral crediting mechanisms could co-exist with the CDM, as long as there are accounting procedures to avoid double-counting³.

The paper starts by making the case for considering sectoral crediting mechanism options, while also acknowledging some of their possible challenges and downsides. Section 1.2 then outlines key considerations to keep in mind when exploring sectoral crediting mechanisms options – almost irrespective of the exact design option. Section 2 describes three design options for sectoral crediting mechanisms with a discussion on (i) baseline and data issues; (ii) participation and earning emission credits; and (iii) institutional issues for each of the design options. Section 3 highlights the key initial insights that can be drawn by this overview of sectoral crediting mechanisms. Conclusions are outlined in section 4.

1.1 Rationale for Sectoral Crediting Mechanisms (SCM)

The long-lived nature of much energy-using equipment indicates the value of encouraging cost-effective GHG improvements (compared to business-as-usual projections) when planning new investments. Meeting projected global energy demand will demand considerable investments – estimated at about \$16 trillion from 2003 to 2030, or \$568 billion per year (IEA 2004b). New policies/means/mechanisms will need to be put in place to ensure that energy – as well as other socio-economic – needs are met in a more climate-friendly manner. The alternative – under a business-as-usual scenario - is largely irreversible investments in GHG-intensive capital and higher GHG mitigation costs in the future.

An important focus of analysis of effective greenhouse gas mitigation approaches should be on options providing greater opportunities for cost-effective emission mitigation - especially those that can provide incentives to reduce the GHG intensity of projected new investments.

Market-based instruments aim to help achieve cost-effectiveness in GHG reduction by providing flexibility with respect to the location of actual mitigation activities undertaken. These instruments, when implemented well, should also be more compatible with the private sector’s business practices. As pointed out by Diringer in Aldy et al. 2003, “only markets can mobilise capital and technological prowess on the scale needed [to dramatically reduce GHG emissions]” although “the direction and imperative must come from governments”.

³ A relevant discussion on double counting and how to address it can be found in Bygrave and Bosi (2004).

In the context of the Kyoto Protocol, most industrialised countries have adopted emissions obligations. These obligations are based on a comprehensive country-wide approach that gives the possibility to mitigate emissions wherever they are less costly. However, as noted by a number of experts (e.g. Philibert and Pershing 2001, Schmidt et al. 2004, Bodansky et al 2004, etc.), there are several rationales for considering possible market-based approaches on a sectoral basis, e.g.:

- Most countries do not have country-wide emission limitations under the Kyoto Protocol. If such countries were to take on some form of emission limitations in a future climate regime, it may be more feasible, from a policy, institutional and economic standpoint, to start on a sectoral basis. Building technical capacity may be more manageable at a sectoral level (recognising that it may be more difficult for some sectors, e.g. forestry, than others).
- It is easier to target a given sector instead of the entire economy and to introduce policies and/or measures that lead to GHG reductions. Some governments may prefer to focus emission reduction efforts in energy intensive industries, rather than the consumption sectors (e.g. households) that are more directly linked to social welfare.
- As a means of policy coordination, a sectoral focus would help address competitiveness concerns within a given industry, which remains a barrier to more ambitious emission goals for some industries in countries with emission commitments.
- For some sectors, a few multinationals hold a prominent market share. These actors may easily diffuse best practice stimulated by a sectoral crediting mechanism.

Sectoral crediting mechanisms could build on experience, institutions and decisions taken under the Kyoto Protocol's CDM. The development of consolidated methodologies in particular, could provide a very useful starting point for discussions on sectoral baselines⁴.

1.2 Some Key Considerations

There are different possible "dimensions" to keep in mind when assessing options for sectoral crediting mechanisms. For instance, it is important to consider who are the main actors and the recipients of credits, e.g. governments, industry and/or individuals. This may differ according to the mechanism's design, itself a function of the targeted sector and countries' capacity. This section highlights a few cross-cutting issues for consideration in the design of sectoral crediting mechanisms.

1.2.1 Sectors

The following criteria/considerations are likely to be important when examining sectors that may be covered by sectoral crediting mechanisms:

- Contribution of sector(s) to greenhouse gas emissions at the global and/or national level. Differences emerge when comparing countries' situations for individual sectors (see Table 1). Differences are

⁴ The development of consolidated methodologies is based on the methodologies developed and submitted to the CDM Executive Board by individual project proponents. However, some have commented that this process penalises those that incur the initial baseline development costs to the benefits of future project proponents that may benefit from the consolidated methodologies. Ensuring that the baseline development costs are shared more broadly while at the same time still motivating the development of consolidated methodologies may require considering possible public-private collaboration.

more pronounced between developing countries than between industrialised countries (see LULUCF, agriculture, or transport).

- Age and life of capital stock. Sector dynamics (e.g. rapid growth vs declining activity) and whether significant investments are projected in the sector(s) can differ significantly between different sectors and countries.
- Availability and reliability of data. For example, the IPCC estimates that there is an uncertainty range of $\pm 5\%$ on energy-related CO₂ emissions in countries with good energy data collection systems. The uncertainty range may be in the order of $\pm 10\%$ in countries with less well-developed energy data collection systems (IPCC 2000). Uncertainty levels are much greater for other gases and sources. Reliable sectoral emissions inventories are a prerequisite for proper implementation of the mechanisms considered in this paper.
- How to define a sector and its boundary. Different countries may have different definitions for a given sector and its boundary. Different definitions can have important implications for the determination of baselines and assessment of claimed emissions reductions in given sectors.

Table 1: Key Sectors' Share of Selected Countries' and Regions Total Greenhouse Gas Emissions in 2000

	Energy	Transport	Industrial Processes	Agriculture	LULUCF	Waste
World	48.8	11.8	3.4	13.8	18.6	3.6
Annex I	65.3	19.6	3.6	8.2	n/a	6.2
Non-Annex I	36.9	6.1	3.2	15.6	35.1	3
China	64.6	4.6	7.9	21.4	-1	2.5
India	52.3	6.8	3.5	34.8	-2.2	4.8
Indonesia	7.9	2	0.5	4.0	83.6	1.9
South Korea	68.8	17.5	9.2	2.8	0.2	1.6
Brazil	8.8	5.7	1.5	20.1	62.0	1.8
Mexico	50.5	16.6	3.5	8.2	15.8	5.3
South Africa	73.7	9.6	2.7	10.7	0.5	2.9

Source: WRI (CAIT) accessed 24.1.2005

As noted, the most appropriate sectoral crediting mechanism to create incentives and opportunities to reduce emissions may differ according to different types of sectors. It may be useful to “group” or identify different categories of sectors. For instance, the Triptych approach (Phylipsen et al. 1998) used in EU burden sharing discussions of the late 1990s distinguished three categories of sectors (only energy-related CO₂ was considered) which provide a useful starting point for thinking about different sectors. The three categories/groupings were (i) the power sector; (ii) internationally-operating energy-intensive

industry; and (iii) remaining domestically-oriented sectors. LULUCF activities could form a fourth sector. Some of the principal distinctions between the various categories of sectors are highlighted in Box 1.

Box 1: Distinctions between different ‘categories’ of sectors

- **Power sector industry:** it is a typically well-understood industry with relatively few players in each country. National circumstances in terms of resource endowment have significant implications on the sector’s GHG emissions, which is responsible for a large share of many countries’ CO₂ emissions. It is a sector characterised by long-lived capital. Projections indicate that significant investments will be needed in that sector, particularly in developing countries (IEA 2004b). In many countries, the power sector comprises large state-owned companies. Reliable and affordable access to electricity is often considered as a basic development service⁵. The power generation sector is often considered as a good candidate for emissions trading schemes as well as project-based mechanisms.
 - **Internationally-operating industries:** these are industries whose products compete on international markets. Industries in this category are thus potentially sensitive to international competition if subject to costs while competitors are not. These industries appear well-suited for market-based mechanisms. Information on these sectors’ key technologies and mitigation options is usually not widely disclosed and is generally less available than in the power sector. Governments are more likely to suffer from asymmetrical information when negotiating commitments in these sectors. Some of the industries included in this sector category are largely dominated by few large multinationals. Industries that would be part of this category include aluminium, iron and steel, pulp and paper, and cement.
 - **Domestically-oriented sectors:** these include buildings and transportation where sources of greenhouse gases tend to be many and diffuse – and consequently challenging to manage. However, they add up to a non-negligible share of countries’ GHG emissions.
 - **Land use, land use change, and forestry (LULUCF):** This sector category includes sources and sinks of GHG emissions in the agriculture and forestry industries. They are the subject of particular treatment in the context of the Kyoto Protocol and Marrakech Accords. This sector category is typically characterised by significant uncertainties in emissions estimates.
-

1.2.2 Competitiveness Issues

Expanding the coverage of GHG commitments with sectoral crediting mechanisms will tend to lower competitiveness concerns on the part of those actors that are now covered by a GHG constraint and incur costs as a result (i.e. actors in countries that have adopted GHG commitments under the Kyoto Protocol). Indeed, any new policy involving a GHG constraint is likely to raise competitiveness concerns among actors that were not, to date, covered by the same GHG constraint. While these concerns may be of a secondary order when compared with overall progress achieved with a broader GHG policy coverage through sectoral crediting mechanisms that involve greater participation, some issues are worth considering.

Two main types of competitiveness issues can be distinguished:

1. **Inter-industry:** competition from firms that produce possible substitute products in a given market (plastics, glass steel and aluminium in the automotive market);

⁵ This was highlighted, for example, at the IEA’s *Electricity & Development Workshop* held in Paris on January 17-18, 2005. See also Chapter 10 of IEA 2004b.

2. International: competition from different firms in the same industry, located in different countries.

International competitiveness issues could arise in sectors where products are widely traded, or where location choices are many for new installations. Inter-industry competition could matter if the implementation of a mechanism on a sector triggers increases in emissions in a competing sector that is not covered by a similar mechanism – plastics, for instance, are not covered by the EU Emissions Trading Scheme (EU ETS), unlike aluminium, steel and glass - although they sometimes compete for the same end-uses. The comprehensiveness (which sectors, which countries) and stringency of the mechanisms will determine the significance of these concerns.

1.2.3 Free riding risks and other issues

Free riding in the context of sectoral crediting mechanisms refers to (public/private) entities being able to generate emission credits from business-as-usual behaviour. The more stringent the emission baseline, the less probable free-riding will be. Not allowing existing installations (i.e. those existing prior to the implementation of a SCM) to participate would also greatly reduce risks of free-riding. On the other hand, an emission baseline set at the level of an exaggeratedly high BAU combined with crediting could provide an undue competitive advantage (i.e. a subsidy) to certain participants. In a worse case scenario, it could encourage producers to change locations to benefit from crediting while not improving the environment. In practice, it may be impossible to eliminate all free-riding. What is more important is to ensure that the mechanisms lead to *overall* emission reductions compared to BAU trends.

Many of the possible options discussed in section 2 only result in a supply of emission credits, implying that somewhere, someone must have binding stringent emissions obligations to generate a demand for emission credits resulting from sectoral crediting mechanisms. The demand part of the equation is key, but it is well covered in the literature and not further addressed in this paper. Sectoral crediting mechanisms could be designed to be binding - and therefore effectively impose a legal obligation for emissions levels in a given sector to be below an agreed fixed or indexed sectoral baseline/limit. A binding emission baseline or limit implies some consequence for non-compliance. A non-binding mechanism would allow generating credits if emissions in covered sector(s) are below the baseline, but would not require purchasing allowances if emissions are above the baseline. Non-binding sectoral crediting mechanisms can be designed to provide incentives (in the form of credits) for greater GHG-friendly investments and may be an attractive proposition to increase engagement of countries (Philibert et al. 2002, Philibert and Pershing 2001). Samaniego and Figueres (2002) also caution that negotiations on binding baselines may involve the moral hazard of seeking to set lax (exaggerated) baselines, leading to surplus credits, often referred to as “tropical hot air”. In the end, the environmental effectiveness of these mechanisms – binding or non-binding – will depend on whether they reward emission reductions beyond BAU trends, which depends on the stringency of agreed baselines.

2. Some Design Options for Sectoral Crediting Mechanisms

This section examines different ways a crediting mechanism could be designed on a sectoral basis.

Prior to examining in detail different possible options for sectoral crediting mechanisms, it is first useful to clarify two distinct approaches to setting-up of sectoral mechanisms:

- i. trans-national sectoral mechanisms. These would seek to encompass companies operating in a given sector world-wide (or the majority of them). This wide reach would help to alleviate competitiveness concerns. A transnational approach may be particularly relevant for the internationally-operating industries described in Box 1. Den Elzen and Berk (2004) note that this approach is also suitable for international transport (e.g. aviation)
- ii. national sectoral mechanisms. These would involve national governments proposing baselines for some of their sectors, as a means of providing incentives to exploit GHG-reducing opportunities by attracting GHG-friendly investments with sectoral emission credits. Government-based sectoral mechanisms may also be seen as a first – manageable – step to mitigate emissions (compared to BAU or another baseline) in a given sector.

The implications of these alternative choices will be examined below in the context of three sectoral crediting mechanisms options:

- Sectoral policies. This type of mechanism would generate credits by adopting and implementing GHG-friendly policies in particular sectors;
- Fixed sectoral emission limits (binding or non-binding), where emissions “credits” could be generated if a sector or company emits at a lower level than an agreed limit; and
- Rate-based or indexed crediting, where entities or projects emitting below a certain level (e.g. X tCO₂/unit of output) would generate credits.

These options could be combined, e.g. a national crediting mechanism based on a sectoral policy with a fixed sectoral emission limit. However, each option is examined generically, on an individual basis, according to the following elements:

- Baseline and data issues
- Participation and earning emission credits
- Institutional issues.

Key criteria and considerations for each of the elements noted above are: (i) environmental integrity; (ii) ease of implementation; and (iii) effectiveness.

For the purposes of this report, the following definitions are used:

- “Policies” refer to a governmental policy (e.g. tax, standard, regulation) in a specific area. A policy could cover a whole sector, e.g. transport, cement manufacture, or part of a sector, e.g. production of adipic acid.
- “Binding” refers to an obligation to meet a certain target or achieve a certain performance, with consequences for non-compliance.

- “Non-binding” refers to the possibility of generating credits if the emission performance is below the baseline/target, but without any consequences for exceeding the baselines/target.

2.1 Sectoral policies

Government policies can have a significant impact on activities, infrastructures and investments within their countries, and thus on greenhouse gas emissions. Policies that seek to meet non-environmental objectives (e.g. in energy, industry, transport, agricultural, buildings, etc.) can also have significant implications for greenhouse gas emissions. These policies can trigger investments in long-lived capital, with lasting GHG emissions and implications for future mitigation costs, especially if capital must be retired prematurely (i.e. prior to the end of its economic lifetime). It is thus important that greenhouse gas aspects be taken into account in the development of these policies.

Much literature exists on the implications of alternative policies on investments in a given sector and their associated greenhouse gas emissions. For example, the 2004 World Energy Outlook (IEA 2004b) describes an Alternative Policy Scenario that is more efficient and environmentally-friendly than its Reference Scenario (Box 2). It would lower energy-related emissions growth by 16% using only policies currently under consideration by governments. Indeed, many such policies are already underway. For example, policies in the transport sector – arguably the most challenging for GHG mitigation – are being developed to put transport systems on more sustainable paths (e.g. IEA 2002b, IEA 2001)⁶. Cities like Curitiba in Brazil, and New Delhi in India are making headway in the area of urban transportation⁷.

Sectoral crediting mechanisms that would reward the adoption and implementation of GHG-friendly policies could help lower countries’ emissions trends while helping meet other socio-economic objectives. In theory, SCMs based on sectoral policies should provide incentives to governments to transform entire sectors and thus help developing countries to engage in low-GHG intensive developing pathways (den Elzen and Berk 2004). This would indeed be a way to design national sectoral mechanisms where national governments would propose policies for one or more of their sectors as a means of providing clear signals for GHG-reducing activities.

Samaniego and Figueres (2002) identified the value of making government GHG-friendly policies eligible for emission credits if these policies resulted in emissions below a business-as-usual baseline. In this context, they propose a “sectoral CDM”, that could take the form of, for example, the modernisation of the entire cement industry in a country as a result of a government policy, or the implementation of an energy efficiency standard for industrial motors. The “sectoral CDM” could be built on the Kyoto Protocol’s CDM. It would be designed to encourage governments to adopt GHG-friendly policies leading to substantial GHG reductions. Figueres (2004) further confirms the need to develop a mechanism that would enable mainstreaming GHG considerations into economic development policy-making. The possibility to earn emission credits may be sufficient incentive to undertake broad-based policies that would not be undertaken otherwise⁸.

There are currently two projects being elaborated involving policies (rather than “bricks and mortar”) with the objective of earning CDM status and generating certified emission reductions. The Urban Transport

⁶ See also <http://embarq.wri.org/en/index.aspx>

⁷ For more information, see, for example, http://www.worldbank.org/transport/urbtrans/pub_tr/curitiba_summary.pdf

⁸ However, it is important to recall again that governments undertake policies for different reasons with different objectives in mind – which may not always depend on the financial profitability of policies.

Modernization Plan for Santiago, Chile (Transantiago)⁹ – which is in a pre-validation stage – is described as an initiative by the State to change the transportation system of the Metropolitan Region of Santiago to improve quality of life, with an integrated, efficient transportation service with low environmental impact. This project entails operational and technological changes using bus route concessions, which depend fundamentally on the participation of private firms. The other ‘policy’ project is the Mandatory Energy Efficiency Standard for Room Air Conditioners project in Ghana. It involves the development and implementation of a mandatory standard to increase the average efficiency of room air conditioners beyond business as usual. This would result in a lower electricity demand for air conditioning and thus reduce the GHG emissions associated with electricity generation. The corresponding baseline methodology was submitted to the Methodologies Panel of the CDM Executive Board¹⁰ in November 2004.

Should the CDM Executive Board approve these ‘policy’ projects (and underlying methodologies), they would effectively pave the way for sectoral crediting mechanisms based on sectoral policies pre-2012. This may give the sectoral crediting mechanism option based on sectoral policies a significant institutional advantage over other possible options considered in this paper.

⁹ The Project Design Document, version 02 (July 1, 2004) which was submitted for pre-validation can be found on the DNV website: <http://www.dnv.com/certification/climatechange/Projects/ProjectDetails.asp?ProjectId=121>

¹⁰ The project design document can be found on the UNFCCC website: http://cdm.unfccc.int/UserManagement/FileStorage/FS_837046608

Box 2: IEA's Reference Scenario and World Alternative Policy Scenario

The IEA's World Energy Outlook 2004 compares its Reference Scenario with a World Alternative Policy Scenario (WAPS) that depicts a more efficient and more environmentally-friendly energy future. This Alternative Policy Scenario demonstrates that policies to address environmental and energy-security concerns that countries are already considering, together with faster deployment, would substantially reduce energy demand and CO₂ emissions. In 2030, the world energy-related CO₂ emissions associated with the Alternative Scenario are reduced by 6,013 MtCO₂ compared to the Reference Scenario (i.e. 32,201 MtCO₂ instead of 38,214 MtCO₂ in 2030).

Changes in Energy-Related CO₂ Emissions by Sector and by Region in the IEA 2004 Alternative Scenario*, 2030 (MtCO₂)

	OECD	Transition Economies	Developing countries	World
Power generation	-1,627	-340	-1,938	-3,905
Industry	-134	-78	-371	-583
Transport	-557	-59	-381	-997
Other	-193	084	-251	-528
Total	-2,511	-561	-2,941	-6,013

* Change relative to Reference Scenario

As a result of different policies, the pattern of energy investments in the WAPS would differ from that foreseen in the Reference Scenario. For instance, in aggregate, the WAPS' larger capital needs on the demand side are sometimes more than offset by lower needs on the supply side. However, the amount of capital required for the entire energy chain – from energy production to end-uses – would not differ much between the two scenarios.

Source: IEA (2004)

2.1.1 Developing/reviewing/approving a baseline

A sectoral crediting mechanism based on sectoral policies would allow governments to earn emission credits if they implemented and enforced sectoral policies that lead to emission reductions from a pre-established baseline. This sectoral policy baseline could be constructed to reflect a business-as-usual policy scenario.

However, in practice, it may not always be straightforward to determine what should and should or not be included in such a baseline (as with other options examined in this paper). Countries' national circumstances will need to be taken into account. It may also be important to consider different countries' "good governance" and efforts to limit GHG emissions. The following two examples seek to illustrate possible distinct situations that may arise and their implications for the determination of policy baselines:

Example 1: A country may have certain environmental regulation(s) but does not enforce it/them, which leads to emissions of GHGs. Should the policy baseline assume that the environmental regulation continues not to be enforced? Some argue that such a baseline would effectively create an incentive to do what the government *should* do - i.e. put in place a policy to enforce the regulation - through the possibility to earn valuable emissions credits via a SCM. An example may be countries that do not (or not sufficiently) enforce gas flaring legislation. It can be argued that by reflecting the non-enforcement of the regulation(s), policy baselines would recognise what the government *is* doing (i.e. the reality of the country) and create incentives to reduce GHG emissions - which is the goal of sectoral crediting mechanisms. In fact, the most important question should be whether this affects the environmental outcome in terms of GHG reductions. However, it could also be argued that developing a policy baseline in a way that it recognizes the non-enforcement of policies would create a perverse incentive for what can be perceived¹¹ as “bad governance” – simply to have a more GHG-intensive sectoral policy baseline and be able to generate more credits. This assessment may not be straight-forward in practice.

However, the perverse incentive, if averred, would lead to an inflation of emission credits in the beginning, as governments delay policy implementation, but all new investments and developments in the boundary of this policy would be contributing to lower emissions. The CDM, in comparison, can create a perverse incentive not to introduce policy – and an inflation of credits – for as long as it allows project-crediting, or until the baseline is lowered.

Nonetheless, one possible way to limit risks of a policy baseline resulting in an inflation of emission credits may be to discount a portion of the claimed emission reductions. The determination of that proportion would be arbitrary, however. For example, Dr. Yamagata¹² suggests that emission credits could be limited to 50 percent of claimed emission reductions under a possible sectoral CDM implemented post-2012.

Example 2: A country may have developed policies to address sustainable development priorities but not have enforced any legislation to do this. For example, in 1995, Costa Rica announced a requirement that privately-generated power would need to rely on renewable energy sources (Figueres 2004), as a policy contributing to protecting the global climate system. However – as is the case in other countries with a privatised power generation sector - it is unclear that the private sector will fully respond to this requirement, as actual private investments will depend on the economics of different alternatives. Plans for greater electricity interconnection in Central America may also mean increased imports from fossil fuel-generated electricity. As a result of that policy announcement, many are now questioning whether any renewable energy projects in Costa Rica can earn CDM credits, as the baseline should be based on renewable energy sources. Some argue that Costa Rica’s renewable energy policy is now part of the business-as-usual baseline¹³ for its electricity sector. Others make the case that this leads to a perverse incentive (e.g. Figueres 2004) and that a sectoral policy baseline should be developed in a way that the

¹¹ There may be different reasons for the non-enforcement of regulations – some of which may be considered legitimate while others not.

¹² See Dr. Hiroshi Yamagata’s presentation on ‘The Future of CDM – Design post-2012 CDM for incentives to promote energy savings and renewable energy in developing countries’ given at the IETA side-event, COP-10, December 2004, Buenos Aires (<http://www.ieta.org/ieta/www/pages/getfile.php?docID=682>)

¹³ In fact, the CDM Methodologies Panel did not approve (May 2003) the methodology for the proposed CDM “Peñas Blancas” hydroelectric project in Costa Rica, because it was not convinced that the proposed project activity was in fact not part of the baseline scenario, given that it is consistent with the government’s power generation expansion plan (<http://cdm.unfccc.int/EB/Panels/meth/CallForInputs/inputsarchive/NM0008>).

CDM¹⁴ – or a future sectoral crediting mechanism – could help the country to pursue its GHG-friendly policies – and not exclude it from the mechanism.

The CDM Executive Board has reacted to this concern. In fact, the Executive Board provided some clarification on the treatment of national and/or sectoral policies and regulations in determining baseline scenarios which aims to limit possible perverse incentives discussed above (EB 16 Report, Annex 3, 21-22 October 2004). It clarifies that national and/or sectoral policies or regulations that give “positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion on renewable energy or to finance energy efficiency programs)” that have been implemented since the adoption of the CDM’s modalities and procedures by the Conference of the Parties (i.e. 11 November 2001) “may not be taken into account in developing a baseline scenario...”. This means that the baseline scenario may refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place. Such guidance certainly helps address the concerns raised by Figueres and others, but it is unlikely to address the concerns of early-movers, such as Costa Rica, that have implemented greenhouse gas friendly policies before 2001. The practical implementation of the EB’s clarification - with respect to the assumptions for the baseline scenario seeking to reflect what would have happen without the GHG-friendly policies – will be key.

The development of policy baselines may thus demand some consideration of the type of ‘policy’ incentives and signals that are provided, along with the projected emissions trends. Including such considerations in negotiations in the approval of baselines would likely require significant data and information, starting with GHG inventories and government plans in sectors under consideration. Transparency/opacity may vary by sector as well as by country. In the end, a subjective assessment will likely be needed to gauge whether the introduction of possible emission credits creates an opportunity for climate-friendly policies.

The development of a sectoral policy baseline would also require defining the appropriate boundaries, a more or less challenging task depending on sectors.

Sectoral policy baselines could be defined – at least in principle – as either fixed or indexed baselines (as discussed later). However, they would need to be approved *ex-ante* to provide clarity and to avoid risks of *ex-post* gaming (i.e. exaggerating the baseline). The process to get international recognition for the baseline may involve the government making the case (a sort of pledge), with supporting data, to the international community, followed by some type of international review/negotiation on the policy baseline so as to ensure the legitimacy and recognition of the claimed emissions credits. Different governments could choose to propose different sectors, or if practical, the negotiation may involve different countries proposing baselines for same sectors.

2.1.2 Participation and earning credits

Some governments from developing countries may be more interested in engaging in international discussions on future climate policy cooperation if their climate-friendly policies could be eligible to generating emission credits. Moreover, a SCM based on sectoral policies could have the advantage of engaging other (than environment) ministries in efforts to reduce GHG emissions. Integrating GHG consideration into broader economic development policy-making through a sectoral *policy* crediting

¹⁴ There is a concern that the CDM could create a perverse incentive not to introduce a sector-wide GHG-friendly policy that could otherwise make sense for the country, but would prohibit future CDM credits to be earned in that sector.

mechanism could effectively lead to clearer and possibly longer-term policy signals and potentially lead to significant GHG reductions

A very simplified – but potentially too blunt – way of calculating emission reductions from a policy may be to subtract sector emissions (based on the sectoral emissions inventory) from the projected sectoral policy baseline (defined, for example, in terms of tCO₂/sector GDP, or a fixed amount) and assume that all reductions in year X are the result of the sectoral policy.

However, in reality, several factors are at play in any given sector. A more accurate way of crediting a given sectoral policy would require a transparent assessment of the impact associated with the policy, and disentangling it from other effects within a sector. Quantifying this may be very challenging. Indeed, isolating and verifying the impact of a given policy is not always straight-forward. For example, although European CO₂ emissions in 2002 decreased compared 2001, the European Environment Agency (2004) does not identify a particular climate policy to explain this reduction. Other factors include probably (i) warmer weather in Europe; (ii) slower economic growth in manufacturing industries; and (iii) a continued shift from coal to gas; yet the exact contribution of these factors is difficult to assess. Efforts are underway, however, in several countries to assess the impact of government programs and policies from an overall observed trend. For government agencies, such assessment work may be necessary to justify the continuation of policies and programs. These efforts may provide useful information on possible options to calculate the emission reductions attributed to a given climate-friendly government policy under a SCM. Box 3 highlights how the Canadian government is measuring the impact of its energy efficiency initiatives on energy consumption and greenhouse gas emissions from observed trends.

Box 3: Canada's Office of Energy Efficiency's Approach to Government Programme Performance Assessment and Monitoring

The Office of Energy Efficiency's performance assessment/monitoring work evolves primarily on 3 fronts. The OEE first develops the capacity to monitor overall market trends in energy efficiency in order to analyze and track changes in the various energy consuming market segments targeted by its end-use efficiency programs (e.g. residential appliances, buildings envelope, industrial production). Analysis of these trends is presented in an annual report. The National Energy Use Database initiative helps to maintain this monitoring capacity by collecting data from a variety of sources, including national energy consumption surveys.

Secondly, the OEE develops an indicator-based framework for measuring the performance of its programmes based on each programme's annual outputs, targets and outcomes. This framework is applied to all new and existing programme activities, and helps constitute the first link between programme activities and observed market changes in energy efficiency. Natural Resources Canada uses this framework, as well as information on overall energy efficiency trends, to report to Parliament on the overall progress of its initiatives annually.

The third and most recent component of the OEE's programme performance assessment work deals with the development and application of methodologies that address the issue of programme attribution over the observed energy efficiency market evolution. This final step provides the capacity to assess the influence of individual government programmes towards quantifiable policy objectives such as climate change mitigation and sustainable development.

The methodologies used were derived from Discrete Choice Theory, which has been used in the private sector to estimate the change in behaviour that can occur (either for an individual, or for a group of individuals) as a result of a firm's marketing efforts, or a utility's programme efforts. These methods are now being applied to public sector programs, and the OEE has conducted 4 such studies to date, for its industry, equipment labelling, home audit and energy efficiency workshop programs.

For example, in 2002-2003, the OEE completed impact attribution studies for two of its energy efficiency programs: (i) EnerGuide for Houses, and (ii) the Dollars to Sense workshop series (a component of Energy Innovators and Canadian Industry program for Energy Conservation). These attribution studies concluded that the combined net impact of the workshops resulted in savings of 3.1 petajoules of energy use per year. The rate of uptake or the installation of different energy efficiency improvement measures (e.g. the installation of more efficient refrigerators or lighting) that could be attributed to the workshops ranged from 0.4 percent for ovens to almost 40 percent for compact fluorescent lights. The net impact of EnerGuide for Houses in terms of energy savings ranges between 0.12 and 0.35 petajoules per year.

By multiplying these energy savings by the appropriate emissions coefficients, the energy savings can be translated into GHG reductions.

Sources: Natural Resources Canada 2004, and personal communications with Michel Francoeur (IEA), Malika Nanduri and Charles Spelay (OEE, Natural Resources Canada)

The negotiation on crediting will need to consider the pros and cons of different accounting methods, in conjunction with the level of the baseline. For example, the straightforward subtraction method may be acceptable if the baseline is more stringent.

Given that it is governments that develop and implement policies, it would be simpler for governments to claim the credits. It is unclear how private project developers would be affected – or how they could benefit - by a sectoral crediting mechanism based on sectoral policies. Sectoral policies may provide *incentives* to reduce GHG emissions in a given sector, or they may be designed to provide specific *obligations*. It may be that sectoral policies are combined with another mechanism more directly aimed at private entities' actions, e.g. a project-based mechanism in the same¹⁵ or other sectors. The possibilities and implications of combining crediting for governments' sectoral policies and crediting for private entities activities in a given sector would warrant more in-depth investigation.

It may also be useful to note that the impacts of policies are typically not felt instantaneous but rather with a time lag. This may be important to take into account when deciding on the crediting period for sectoral policies.

2.1.3 Management and Institutional Issues

The host country government would play a central role under this option. One can envision two broad options for the international management of a sectoral policy crediting mechanism:

- 1) The institutional system could essentially follow the current CDM model (validation by an independent entity of proposed policies, submission for registration to the equivalent of the CDM's Executive Board).¹⁶ There could be opportunities for stakeholders and other Parties to voice their comments on the proposed sectoral policies. This could take the form of a hearing, or a written procedure could be followed.
- 2) The institutional system governing a sectoral crediting mechanism for sectoral policies may be based on multilateral negotiations. Under a sort of pledging process, countries interested in participating in a sectoral crediting mechanism would make their case to the international community involved in a future climate regime and a final agreement would be the result of multilateral negotiations¹⁷. This would require developing and agreeing to criteria in advance, as well as rules of procedures.

It is not clear whether, under option 2, Parties would not decide to create a separate process to prepare discussions and approval. The key difference between the two options relates to the entity providing final agreement (the equivalent of the CDM's Executive Board or Parties as a whole). The institutions to oversee a sectoral crediting mechanism based on GHG-friendly sectoral policies may therefore be a combination of examples 1 and 2 above, involving some multilateral negotiations and an executive body to oversee day-to-day operations of the sectoral crediting mechanism.

Host governments could seek emission credits once the registered policies have been implemented and reductions can be documented. If the agreement is that emissions below the baseline result from policy and should be credited, i.e. the simple but 'blunt' method discussed in 2.1.2, (at the risk of reducing accuracy), the verification stage would involve ensuring actual implementation of the policy as originally planned. Otherwise, the verification stage would involve an assessment of the exact impact of the sectoral policy on the covered sector's emissions. The institutional requirements to make that assessment – both at

¹⁵ Risks of possible double-counting would need to be examined in such a case (see Bygrave and Bosi 2004).

¹⁶ Unless Designated National Authorities (DNA) could be structured independently from the government, it may not be necessary to have government policy proposals approved by DNAs.

¹⁷ There may be lessons learned from international trade or other multilateral negotiations, but this would need to be explored further.

the country and international levels – may be significant, depending the assessment process and rules. Countries involved in the climate regime would likely need to agree on guidelines for the evaluation of sectoral policies and their baselines to ensure coherent treatment of different GHG-friendly sectoral policy proposals. A comprehensive assessment process may be onerous and demand significant capacity and expertise.

Regardless of how the international decision-making institutions are developed (e.g. 1 or 2 above), the host government would be expected to have greater oversight on the generation of credits within its borders than it currently has under the CDM. Host governments would need to make their case for sectoral policies and the appropriate baseline. This may well require greater institutional capacity than what exists under the CDM in many countries. The government would be responsible for: establishing and documenting the baseline, providing a reliable GHG inventory, preparing negotiations / approval processes.

2.2 Rate-based¹⁸ (indexed) sectoral baselines

There has been much discussion in the climate and economic literature of rate-based (or indexed) baselines (e.g. Baumert et al. 2002, IEA 2002a, Bodanski 2004, etc.). Various authors have argued that national commitments based on rate-based baselines (including targets) are attractive because they allow taking explicitly into account some key - but difficult to predict – variable(s), such as GDP in many countries¹⁹. By construction, an emission baseline set as a certain quantity of GHG per unit of GDP, for example, allows higher emissions in cases of higher economic growth. By reducing the cost uncertainty associated with meeting certain indexed (but not fixed) emission levels, some authors (e.g. Philibert et al. 2003), argue that rate-based emission targets may offer greater political feasibility for countries that currently do not have any emissions obligations under the Kyoto Protocol and thus better prospects for broader participation in a future climate regime. Rate-based baselines are also preferred for the standardization of baselines for most types of projects in project-based mechanisms (e.g. UNEP/OECD/IEA 2001). In fact the methodologies proposed for most CDM project candidates seek to define a rate-based baseline.

Rate-based baselines defined at the sectoral level could take different forms, e.g. GHG emissions per unit of physical output, or GHG per unit of value of output²⁰, or another appropriate metric (UNEP/OECD/IEA 2001). In the case of an emissions trading scheme covering (a) certain sector(s), rate-based baselines can allow emissions to follow activity, so as to not overly constrain a sector's growth (a concern raised in the case of fixed baseline levels²¹). Rate-based baselines can easily accommodate new entrants in a covered sector, provided these entrants meet or beat the baseline, or acquire allowances to cover emissions above baseline, on a per-unit of output basis. In addition, the entry of new producers in a given sector would not increase the stringency of the baseline for incumbents. Costs of meeting a sectoral rate-based baseline - compared to fixed baselines - may also be easier to control, if the baseline indicates a well-identified

¹⁸ Also referred to as 'dynamic' baselines in Philibert et al. (2003).

¹⁹ Torvanger et al. (2004) list authors who propose to replace fixed emission caps with rate-based emission caps.

²⁰ For example, one of the criteria from industries covered by covenants under Canada's proposed scheme for the Large Final Emitters Group is that they have an emissions intensity of at least 20 kg CO₂e/\$1000 of output. (http://www.nrcan-rncan.gc.ca/lfeg-ggef/English/reductions_en.htm)

²¹ However, it can be argued that this concern is of a theoretical nature. A facility with a fixed emissions cap that experiences rapid – and greater than expected - growth in output also generates greater than expected revenues – some of which could be used to purchase emission allowances. The advantage of emissions trading schemes (even with fixed emission limits) is to provide flexibility so as to not constrain output – unlike command-and-control approaches to GHG mitigation.

technology and sources have access to a technology that beats this “standard” (Baron and Bygrave 2002). Given a clear sectoral baseline and the possibility to earn emission credits, there should be incentives to reduce emissions beyond the baseline level where cost-effective.

Rate-based baselines do not provide certainty on the fixed level of emissions from a sector. On the other hand, compared to fixed baselines, rate-based baselines may be a better means to take into account highly uncertain activity growth and to reduce inclinations towards setting an overestimated sectoral baseline. This would reduce the risks of generating excess credits²². There are different views on the relative merits - from an environmental perspective - of rate-based baselines. The question of the environmental effectiveness of rate-based baselines may not be unrelated to their political feasibility, as politically feasible schemes have greater chances of being implemented and reducing GHG emissions (i.e. what matters most for the environment are actual actions to reduce emissions)²³.

A sectoral crediting mechanism based on a rate-based baseline could be binding or non-binding. As is the case for fixed emission limits, governments adopting a sectoral rate-based baseline under a future international climate regime would ultimately be responsible for ensuring that no credits are sold if overall sectoral emissions are above the agreed rate-based baseline. This would be valid under both binding and non-binding options. Governments may devolve the rate-based baseline to legal entities within the sector to seek to provide greater direct incentives for GHG mitigation, but governments would need to put in place a mechanism to ensure that no entity sells credits if the overall sector performance is above the sectoral rate-based baseline.

A binding sectoral rate-based baseline that has a stringency of at least project BAU will ensure that emissions do not surpass that baseline level *per unit production* (or other chosen denominator).

2.2.1 Developing/reviewing/approving a baseline

Sectoral rate-based baselines could be designed for many sectors. However, different designs and approaches may be needed for different types of sectors:

(i) trans-national sectoral crediting mechanism

A trans-national sectoral crediting mechanism could be based on rate-based sectoral baselines. In other words, a rate-based sectoral baseline for a given sector would apply to all countries covered by the sectoral crediting mechanism. For example, a sectoral baseline could be set for the primary production of steel and the same rate-based baseline would apply to companies in all countries included in the sectoral crediting mechanism. A trans-national sectoral crediting mechanism may best be applied in sectors with homogeneous and internationally-traded products - the internationally-traded industries identified in Box 1 above (section 1.2.1). Sectors where industries are particularly vulnerable to international competitiveness may indeed be most suitable for the development of international sectoral rate-based baselines²⁴. A binding sectoral rate-based baseline could effectively eliminate the risks of loss of competitiveness or leakage, as all companies would be faced with the same rate-based baseline and be encouraged to reduce emissions below that baseline.

²² See, for example, Philibert and Pershing (2001).

²³ See Philibert and Pershing (2001) and Dudek and Golub (2003) for two different perspectives on rate-based approaches.

²⁴ However, identifying the criteria and possible industries that could be considered for trans-national rate-based sectoral baselines – and how - could be the subject of future work.

Negotiations seeking to come up with appropriate rate-based baselines for different parts of internationally-traded industries may be difficult to conduct, as they may require data and information that is not readily available and/or even confidential in some cases. Moreover, setting a sectoral rate-based baseline will involve looking at the range of performances (in terms of GHG or energy) within a given sector to determine an appropriate baseline level (e.g. X kgCO₂/t primary steel). As soon as the level of rate-based baselines is determined, ‘winners’ (with a GHG performance below the rate-based baseline) and ‘losers’ (with a performance above the rate-based baseline) within the sector are identified. Such clear-cut determination of those benefiting - and those not - from a rate-based baseline may lead to politically difficult negotiations, particularly if the rate-based baselines are to be binding.

There may be ways to attenuate the ‘winner’ and “loser” categories, such as through performance standards - instead of benchmarks reflecting best available technologies-, as further discussed below.

(ii) national sectoral crediting mechanism

For domestically-oriented sectors where GHG-intensity is country - or region-specific, a single international sectoral rate-based baseline may not be appropriate. For example, carbon uptake by trees of a given species can vary widely on different sites. The GHG-intensity of electricity generation can also vary significantly at the grid and national level (as shown in Table 2). Different national circumstances and resources availability lead to huge variations in the GHG intensity levels in different countries’ electricity generation sectors, as well as possibly significant changes year-to-year. An international agreement on the appropriate *methodology* (and not *level*) to develop a rate-based sectoral baseline for electricity may be a useful alternative. The work done under the CDM Executive Board on consolidated methodologies for baselines for power generation projects could be a very useful starting point. Box 4 provides an overview of the CDM Executive Board-approved consolidated methodology for grid-connected electricity generation from renewable sources. It is a rate-based baseline methodology which could potentially be built upon and broadened so that it may be applicable to all grid-connected electricity generation sources in a country’s/region’s power sector.

Table 2: CO₂ Emissions per kWh from Electricity and Heat Generation²⁵ of Selected Countries

Country/region	Kg CO ₂ /kWh in 2002*	Kg CO ₂ /kWh * (average 2000-2002)	% difference
Argentina	0.208	0.243	17%
Australia	0.893	0.851	5%
Brazil	0.082	0.086	5%
China	0.740	0.742	0.2%
France	0.07	0.07	0%
India	0.937	0.927	1%
Indonesia	0.717	0.700	2%
Korea	0.434	0.469	8%
Malaysia	0.501	0.468	7%
Mexico	0.581	0.583	0.3%
Russia	0.327	0.323	1%
South Africa	0.841	0.861	2%
United States	0.579	0.587	1%

*CO₂ emissions from fossil fuels consumed for electricity, combined heat and power and public heat plants divided by the output of electricity and heat generated from fossil fuels, nuclear, hydro, geothermal, solar, and biomass. Both public and autoproducers have been included in the calculation of the emissions.

Source: IEA 2004a

²⁵ Different methodologies have been discussed and proposed to calculate emissions from countries electric power generation sectors, e.g. Approved consolidated CDM baseline methodology ACM0002, Kartha et al (2002) etc.

Box 4: Consolidated baseline methodology for grid-connected electricity generation from renewable sources under the CDM

The CDM Executive Board approved a consolidated baseline methodology (ACM0002/version 01, 3 September 2004) based on 8 proposed methodologies for project activities involving grid-connected electricity generation from renewable resources.

The purpose of the consolidated methodology is to ensure consistency in the treatment of similar projects and also to facilitate the development of baselines and assessment of potential emission reductions for project proponents. However, it is not mandatory for project proponents to use this consolidated methodology.

According to the ACM0002 consolidated methodology, the baseline scenario consists of the electricity that would have been generated by the operation of grid-connected power plants and by the addition of new generation sources.

It is specified that a baseline emission factor (EF_y) is to be calculated as a “combined margin” (CM), consisting of the combination of the “operating margin” (OM) and “build margin” (BM) emission factors according to the three steps below. It is requested that calculations for this combined margin be based on data from an official source (where available) and made publicly available.

Step 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) based on one the four specified methods:

- (a) Simple OM;
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM; or
- (d) Average OM

Calculations for each of the four methods are elaborated in the ACM0002 document. It is specified that the dispatch data analysis should be the first methodological choice. Project participants may use the other OM calculation methods, but must justify why they did not use the dispatch data analysis.

Step 2. Calculate the Build Margin Emission Factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO₂/MWh) of a sample of power plant m , as elaborated in the document.

Step 3. Calculate the baseline emission factor EF_y , as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = W_{OM} * EF_{OM,y} + W_{NBM} * EF_{BM,y}$$

where weights, W_{OM} and W_{BM} , by default are 50% (i.e. $W_{OM} = W_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as as described in Steps 1 and 2 above and are expressed in tCO₂/MWh. Alternative weights can be used, provided that appropriate evidence justifying the alternative weights is presented.

For more detailed information on this consolidated methodology, see the UNFCCC website: <http://cdm.unfccc.int/methodologies/PAMethodologies/approved.html>.

The development of sectoral rate-based baselines may need the consideration of several technical issues:

- Considerable expertise may be required to establish a proper metric for sectoral rate-based baselines – with some sectors producing various products – and to decide on the production stage at which the rate-based baseline ought to be set (e.g. emissions based on output or input). Moreover, data availability may prove an obstacle if they are needed at a very disaggregated level.

However, it is important to note that rate-based baselines seeking to reflect the performance of the best-available-technology (BAT) through a process-based standard (or benchmarks) may provide fewer incentives to innovate with new technologies, and less flexibility, than rate-based baselines in the form of performance standards (e.g. Corporate Average Fuel Economy standards)²⁶.

- Work done for the development of emission baselines for industrial projects under the CDM may provide a useful basis of information. Case studies examining possibilities for baseline standardization for project-based mechanisms (e.g. iron and steel, cement, as well as energy efficiency) undertaken under the auspices of the Annex I Expert Group (e.g. OECD/IEA 2000) may also provide a useful starting point. Other groups have also undertaken work on the development of emissions baselines that could provide useful input (e.g. the WBSC/WRI Project GHG Accounting and Reporting undertaken under the GHG Protocol Initiative and the Center for Clean Air Policy's work on Project Based Mechanisms and Future Actions Dialogue).
- Some sectors may demand a baseline differentiation for the performances of existing and new installations. It may also be useful to consider whether to exclude some particular facilities in a given sector from the sectoral crediting mechanism. However, implications, in terms of incentives and environmental effectiveness would need to be examined carefully. For instance, it may be important to consider the particular case of zero-emitting sources in the power generation sector.

Zero-emitting technologies (e.g. renewable energies, nuclear) would logically be encouraged by rate-based baselines as they would always perform below the rate-based baseline level. These power generation sources certainly contribute to meeting GHG objectives. However, given that many are already in place and others are planned under business-as-usual conditions (although by no means to the same extent as fossil fuelled power generation), it may be justified to ask whether they all deserve to be able to generate credits that can be used to offset higher emissions elsewhere.

There are some simple options to limit such free-riding, e.g.: (i) through a stringent rate-based baselines (although an overly stringent baselines would not provide the quantity of credits corresponding to the emission reductions); and/or particularly (ii) through the ineligibility of already existing zero-emitting plants to the sectoral crediting mechanism. Another – more complex – way to address the issue could be to try to define some additionality rule/criteria. However, experience under the CDM demonstrates that the theoretically-attractive concept of additionality has proven extremely difficult (impossible) to implement objectively in practice. Some have even argued that the (investment) additionality criteria can create adverse incentives to renewable energy projects in the CDM (Bode and Michaelowa 2003)²⁷.

Sectoral crediting mechanisms based on rate-based baselines may be politically attractive, but negotiations to arrive at an international agreement/acceptance on sectoral rate-based baselines may demand significant preparation and information. The greater the possibilities for differentiation within a given sector, the

²⁶ See Dudek and Golub (2003) for more discussion.

²⁷ More work may be warranted to assess different possibilities and implications for rate-based baselines in the power sector. See Box 6 for examples of quantity of credits that could be generated *under different baselines*.

more complicated (and data-intensive) become the negotiations on those sectoral crediting mechanisms and rate-based baselines. The capacity of different Parties and the feasibility of conducting such negotiations may merit further examination.

Sectoral rate-based baselines for trans-national sectoral crediting mechanisms could be simpler, as rate-based baselines would be defined once at the international level and apply everywhere, compared to national sectoral crediting mechanism that would require different rate-based baselines for different countries.

However, negotiations to determine trans-national rate-based baselines may be tricky due to the asymmetric information between governments and internationally-operating industries. Moreover, it may be argued these industries operate differently or produce different products in developing and in industrialised countries. Additional research focused specifically on internationally-operating industries would be needed to better evaluate any differences.

Regular updates of the level of the sectoral rate-based baseline may be needed to continue to ensure GHG reductions over time. However, the timing of any baseline reviews should be decided in advance so as to give appropriate information to investors, particularly in context of long-lived capital investments.

2.2.2 Participation and generating credits

Because rate-based baselines allow emissions to increase with economic activity, participation of countries may be enhanced with a sectoral crediting mechanism based on rate-based baselines compared to other possible alternatives. For instance, private sector actors have long asked for the additional flexibility (compared to fixed baselines) that rate-based baselines provide. This could potentially enhance the political feasibility of sectoral crediting mechanisms with rate-based baselines in some countries.

Participation and the generation of credits may differ with (i) a trans-national sectoral crediting mechanism, and (ii) a national sectoral crediting mechanism:

- (i) Trans-national sectoral crediting mechanism: An international agreement on a sectoral crediting mechanism based on a rate-based baseline would likely start with the internationally-operating industries. Negotiations may involve governments from countries where the largest companies in the sector have their head-quarters, or the largest share of world production is located. Industry representatives (e.g. through an international industry association) may also be involved²⁸. Further work would be needed to better outline different participation scenarios (government and entities) and their implications.
- (ii) National sectoral crediting mechanism: International agreements/recognition of sectoral rate-based baselines for domestically-oriented sectors may take the form of pledges by host governments that are approved/accepted by the group of countries involved in a future climate regime. The government is responsible for overall compliance, but can decide whether and how to involve private entities in the sectoral crediting mechanism. In some cases, it may be administratively simpler for the government to be the sole participant in the sectoral crediting scheme and seek to generate emission credits via different policies and measures in the covered sectors (see above discussion on Sectoral Policies). This may be efficient for some sectors, such as the transportation sector where sources are very diffuse. On the other hand, a government may decide to devolve participation in the sectoral crediting mechanism to engage - and provide incentives directly to - private entities. For example, a sectoral rate-based baseline for the power

²⁸ More work would be needed to better illustrate options for conducting in practice such negotiations.

sector may be devolved to all power generation companies in the country, giving them a direct incentive to lower the GHG intensity of their production.

A sectoral crediting mechanism based on a binding baseline may be designed with an allocation of emission allowances *ex-ante*, with a true-up at the end of the compliance period. Domestic emission trading schemes with rate-based caps may provide useful insights.

Under non-binding rate-based baselines, governments could earn emission credits *ex-post*, once information on both the numerator and the denominator of the rate-based baselines is verified. If the baseline is devolved to entities within the sector, their rate-based baseline may need to be binding (on each entity) to ensure that there is no over-selling of credits at the sector level. Another possibility may be that governments with a non-binding sectoral rate-based baseline only allow entities to sell credits *ex-post*, i.e. after the overall sectoral performance is confirmed. However, this may result in significant uncertainty for entities, as their right to sell credits would depend on their performance, as well as on that of others in the sector. More work may be needed in this area to better evaluate options and possible implications.

2.2.3 Management and Institutional Issues

A transnational-type mechanism in a particular sector may be most feasible to set up in the case of industries dominated by multinationals (e.g. over or close to 50 percent of the world market shares in both the iron ore and aluminium sectors are held by the top 5 producers²⁹), as the parties involved in any baselines negotiations would be relatively limited and easier to identify.

As per other sectoral crediting mechanisms, reliable emissions inventories would be needed for the sector. In addition, managing a sectoral crediting mechanism based on rate-based baselines would necessitate reliable and regular information on the denominator of the rate-based baselines, such as production (e.g. either in physical terms or in value).

The cost of setting up the mechanism may be important, but once sectoral rate-based baselines are agreed upon and clear, the transaction costs associated with generating emission credits could be very limited (e.g. lower than under project-based mechanisms) – albeit higher than under a fixed emission baseline where information on production volumes (or other chosen metric) would not be necessary.

All variations of SCMs based on a rate-based baseline will presumably require that governments covered by the SCM are ultimately held responsible for compliance of their sectors, as they are the ones that would accept to submit their sectors to a SCM in a future international climate regime. Under both binding and non-binding SCMs, the government would need to develop the necessary institutions and regulations for any private entity participation in the SCM.

However, some institutional issues hinge on the transnational or national nature of the mechanism:

- (i) Trans-national sectoral crediting mechanism: There may be a rationale for greater international oversight, as there may be economies of scale to be reaped for internationally-operating industries covered under a trans-national sectoral mechanism. This may be a way to ensure consistent and transparent treatment for all entities in the covered industry. Even with clear internationally-set guidelines and even baseline levels, the whole management process would still reside with national authorities. They would be responsible for the issuance of credits. To keep an international check on the issuance of credits, participating governments could be required to

²⁹ E.g., see Reinaud (2004) for more discussion on the market concentration of industries covered by the EU-ETS.

prepare an annual report to provide information on its operation of the sectoral crediting mechanism – which would be reviewed at the international level.

Another possibility to consider may be that of a trans-national sectoral crediting mechanism based on binding rate-based baselines managed as an international sectoral emissions trading scheme. More than one industry may be covered in the scheme, thereby increasing liquidity and compliance options in the scheme. In theory, the allocation of allowances and management of the scheme could be centralized at the international level. The GHG emissions associated with internationally-operating industries covered by a trans-national sectoral crediting mechanism could be separated from countries' national GHG inventories – not unlike the current treatment of GHG emissions associated with international marine and aviation bunker fuels. However, more research would be needed to better assess the practical feasibility of such a management structure and whether, and if so how, governments could still ensure the compliance of their sectors overall.

- (ii) National sectoral crediting mechanism: The coverage of domestically-oriented sectors in a sectoral crediting mechanism using rate-based baselines would be largely managed at the national level. International institutions, such as an Executive Board, may be charged with the development of rules and methodological guidance to ensure some consistency between countries, but the implementation would be done at the national level. If the national government opts for not involving its private sector entities in the national sectoral crediting mechanism, the management and institutional process would likely be similar to that discussed under Sectoral Policies, except there would be no need to justify particular policies or measures; only the result (e.g. the emission per unit of output in the given sector) would count to earn credits.

Domestic institutional requirements could be greater if the host governments decide to involve private entities. Such a scenario would demand the development of typical institutions required to manage emissions trading schemes.

2.3 Fixed sectoral limits

A fixed sectoral limit would impose a fixed cap on GHG emissions (e.g. X tCO₂e) from a particular sector. Emissions “credits” could be generated if a sector's emissions are below its emissions limit. While such a limit may be negotiated based on GHG intensity levels, once it has been agreed, its level would not vary depending on sectoral output. As with other types of sectoral crediting mechanisms, a mechanism based on a fixed sectoral limit could be established as a binding mechanism (i.e. with consequences for non-compliance) or a non-binding mechanism. Alternatively, some countries may have binding limits and others non-binding limits. Further characteristics are discussed below.

2.3.1 *Baseline and data issues*

An emissions target for year N would need to be established prior to year N. A crediting mechanism based on fixed sectoral emission limits could therefore require a sector-wide emissions projection (itself likely to be based on a sectoral emissions inventory and projected economic growth). Total emissions of entities within the sector would be compared with this baseline, and the difference between the emissions and baseline projection would represent the level of credits that could be generated.

Establishing a historical emissions inventory may be more or less straight-forward for different sectors and possibly different countries. It may be challenging for some sectors, e.g. where there are many and/or diffuse emission sources, or where some emissions are un-reported. Moreover, several factors can influence the ease of developing projections for a fixed sectoral emissions limit, as illustrated with the process of establishing National Allocation Plans under the EU-ETS.

These include:

- Homogeneity or otherwise of products and/or their GHG-intensity within a sector. A different output mix could radically affect emission levels. Substitutes with different emission levels (e.g. Portland and blended cements) may warrant attention, especially if lower domestic production can be offset by increased imports, resulting in potential emission leakage. Seeking to project all these factors in detail would not be a simple exercise.
- As mentioned above in the case of policy baselines, sensitivity to external factors (e.g. oil prices, GDP growth, exchange rates fluctuations) would affect the amount of “effort” actually required to keep emissions below the fixed limit.

Whether Parties want to follow an in-depth process to set sector-level caps or whether a political agreement on an overall emission level – based on accurate inventories – (e.g. X% above year Y) will be crucial for the feasibility and potential of this option.

2.3.2 *Reviewing/approving a baseline*

A fixed sectoral limit would need to be reviewed at the national level. The limit itself, or the methodology used to calculate it, could be agreed at the international level prior to the start of the mechanism. Both national and international review could be costly, as is any national allocation process. Further, deciding how to define key factors affecting the limit is not necessarily straightforward, as shown by the EU experience in the development of National Allocation Plans (as outlined in Box 5 below). This illustrates that methodological differences in the determination of sectoral baselines could lead to potentially significant variations in allowable emission levels for a given sector. However, once there is agreement on the methodology and key factors to take into account in the development of a baseline, no further oversight of a baseline would be needed.

Box 5: Experience with establishing sectoral emission caps under National Allocation Plans for the 2005-2007 trading period

Under the 2003 EU Directive on GHG Emissions Trading, EU Member States must develop national allocation plans (NAPs). These are to specify the total quantity of EU allowances that will be allocated for the trading period, and how these will be allocated to installations from the sectors covered under the EU Emissions Trading Scheme (EU-ETS). Norway has also established an allocation plan. This experience could provide useful pointers to issues that may need to be addressed when setting any sector-wide emission limits at the international level, e.g. under a “sectoral crediting mechanism”. In particular, given the flexibility given to Member States in the Trading Directive, several key issues have been treated in different ways by different countries (see below). Such differences can make a significant difference to the total level of an emissions cap. These issues include:

- assessing which year(s) should form the base year, and how to use historical data to calculate base year emissions. This varies between countries’ NAPs. For example, it is variously defined as: the average amount of emissions from three years in the period of 1999-2002 excluding the year with lowest emissions (Poland); average emissions from 2002-2003 (Ireland). The number and date of base years vary in the German plan, depending on the commissioning date of a facility and whether or not its capacity has changed between 2000 and 2002.
- how to set an emissions cap from the base year data. This also varies widely among countries. For example, the German plan gives several different formulae – which one is to be used depends on the date a facility was commissioned, its sector, type of emissions (combustion or process-related), whether it has previously been refurbished to significantly reduce emissions, and whether it is new capacity or not. The French plan uses one formula, but a sector-specific “progress coefficient” and expected production level to determine the emissions cap in 2005-2007.
- what level of sub-sectoral disaggregation is needed. For example, Spain disaggregates the “glass” sector into three, but does not disaggregate the iron and steel sector, whereas Poland does the opposite.
- expected technological improvements within the (sub)-sector. Some NAPs have used detailed sector-specific information e.g. on potential technical improvements as part of their calculations for determining an emissions cap. For example, “progress coefficients” have been used in different countries, e.g. Poland/France – although the value of such a coefficient and the level of disaggregation varies by country.
- role of expert judgement in allocating emission targets. This has varying importance in different countries, with some countries (e.g. Spain) taking company-specific or site-specific factors into account, and others (e.g. France) not allowing for site-specific variations.

Differences in allocation methodologies affect the base year and target year emission levels, which could raise concerns over possible competitiveness implications between companies from different countries competing in the same sector. Nonetheless, the NAPs are to be in line with Member States’ commitments under the Kyoto Protocol and do not change the Member States’ overall GHG commitments.

Sources: EPA (undated), Miljøverndepartementet 2004, MMA 2004, Ministry of Environment, Poland 2004, Bundesrat 2004

In a national review of a fixed sectoral emissions limit, governments are likely to come under intense pressure from emitters regarding targets stringency, as witnessed by the National Allocation Plans under the EU-ETS³⁰. Reviewing and approving a baseline in some sectors can be complicated by the asymmetry of information - i.e. governments have limited technical knowledge of industry's mitigation options and costs. Information on recent trends and likely developments would be needed in order to make a BAU projection of likely emissions, and therefore set a fixed emission limit that represents better-than-BAU performance. Indeed, detailed country-specific and (sub-)sector-specific information on factors such as recent historical/likely future technological improvements, demand growth for outputs, fuel availability has been used in establishing several National Allocation Plans. Sensitivity analyses may also be needed because sharp fluctuations in key variables can also render short-term projections inaccurate. For example, Brazilian/US dollar currency price fluctuations can make imported coke more or less attractive for use in iron or steel production than domestically-produced charcoal – with associated GHG implications.

Long-term signals on emission targets may be needed in order to stimulate investment in GHG-friendly systems that have long-lived capital equipment. However, the further into the future projections are made, the more uncertain they will be. This could mean that deciding on the level of a fixed sectoral emissions target a long time in advance could lead to risks either of “hot air” or overly stringent emission limits. For example, different assumptions about efficiency improvements and meeting renewable energy targets could mean that China's electricity-sector CO₂ emissions in 2030 could range from 3,231 to 4,195 MtCO₂ in 2030. This difference is significant: more than the 1990 CO₂ emissions of the UK and France combined. There is therefore an issue as to whether emission limits should be reviewed on the basis of new information. This is probably more relevant for fixed emission limits spanning a decade or more. The potential implications for sectors involved in such a mechanism would make such review a strategic element, probably requiring a third party review process.

The certainty/predictability for investors under a fixed sectoral emissions target will depend on how it is set up, i.e. whether or not the emission limit is devolved to entities. There is no certainty for a company with low emission levels that it will benefit from the regime if the objective has not been devolved to it and other emitters. This is true for both binding and non-binding limits, because the performance of the sector as a whole depends on the emissions performance of several different companies. How potential credits would then be used to reward more climate-friendly entities is, in the end, each government's choice.

2.3.3 Participation and earning credits

A sectoral crediting mechanism based on a fixed emissions limit may be designed to involve only governments, or both governments and entities. However, even if entities are involved, the government would still be responsible for ensuring that any sectoral fixed emission limit is respected overall.

If individual entities within a sector are allocated credits and given the authority to trade, then “cleaner” firms could be able to accrue credits, providing a direct incentive to improve performance at the company-level. Allocating binding fixed emission levels at the level of installations is the approach followed in the EU-ETS. If a company's fixed emission level is non-binding, it could still have an incentive to reduce emissions, as it could sell credits generated from emission reductions – although this would mean that emissions above any other company's limits (in the covered sector) would need to be compensated by the purchase of credits. Under both binding and non-binding options, it would be the government's responsibility to avoid overselling of emission credits compared to the entire sectoral fixed emission limit.

³⁰ A broader sectoral scheme (ie. involving more countries) should reduce the competitiveness concerns of entities compared to the unilateral EU-ETS.

If credits are not allocated to companies within the sector, e.g. if the sector is majority state-owned or it is deemed too complicated/costly to devolve the baseline and credits, the government would accrue credits if emissions are lower (or carbon sequestration is higher) than the emissions limit. This would give the government an incentive to take measures to reduce emissions in the sector as a whole. It would also render the system similar to that described in section 2.1 on a policy-based sectoral crediting mechanism if the government also accrued the credits generated. However, this approach may not provide an incentive over and above any legislation/regulations in place to improve performance at the company level for two reasons:

- a company improving its performance would not accrue any emissions credits or associated revenue;
- improvements by an under-emitting company could be offset by emissions from an over-emitting company.

Such an approach is therefore likely to be less effective at encouraging entity-level emission reductions, unless governments agreed to pass on some incentives. While such incentives could be directly related to any credit surplus, e.g. a share of credit revenues, they could also be in the form of other benefits such as subsidies or tax exemptions.

2.3.4 Management and institutional issues

Prior to implementing an international sectoral crediting mechanism based on fixed sectoral emissions limits, some international-level decisions would be needed – of which most would also be relevant for other types of broad SCMs discussed in this paper. These would include:

- Whether trading can take place during the commitment period or whether only *ex-post* trading would be allowed – especially if the target is non-binding;
- Whether a form of commitment period reserve would be needed, if trading takes place during the commitment period;
- Which countries and sectors participate in such a mechanism and whether limits are binding or non-binding;
- Whether/how a binding fixed sectoral emissions limit co-exists with other mechanisms, i.e. whether emissions trading occurs within or between sectors that have a target, and/or whether credits generated by CDM or JI-type projects in other sectors/countries can be used to meet such a target. If so, double-counting could be an issue that would need to be considered;
- What verification/oversight/review procedures are needed at the national and international level, and what would trigger such procedures.

National governments could decide if and how to allocate the credits to different actors within the sector(s) covered by a fixed emissions limit. For some countries that have not yet experimented with emissions trading schemes, it may be easier to “start” with managing the sectoral baseline and credits at the government (rather than entity) level. In the end, the government would remain responsible, under a future climate change regime, for ensuring that no credits are sold if overall sectoral emissions are higher than the sectoral fixed limit – whether or not the limit is binding.

3. Cross-Comparisons of Different Mechanism Structures

This paper explores three possible structures for sectoral crediting mechanisms. Although this is a preliminary assessment that has not been “tested” for different sectors or countries, it can nevertheless generate some initial insights. These are outlined in the following sections.

3.1 Environmental effectiveness

Environmental effectiveness can be defined as the extent to which emissions are reduced beyond business-as-usual levels. In the case of SCMs, environmental effectiveness will vary with the detailed design of a mechanism, such as the stringency of any baseline. However, SCMs will have a positive effect on the GHG mitigation in a future climate regime if they attract greater participation and GHG mitigation compared to the current Kyoto Protocol regime. In theory, some level of emission reductions could be delivered by any of the three mechanism types examined in this paper in sectors where a carbon value can provide incentives for greater GHG mitigation through GHG-friendly policies and investments.

Participation and baseline stringency issues will be key in the design of any future sectoral crediting mechanism and in ensuring the mechanism’s contribution to the effectiveness of climate change mitigation – in terms of costs and GHG reductions. A careful balance will need to be struck between broad participation and the risk of generating ‘surplus’ credits. The risk of ‘free-riding’ may be an important consideration, particularly in the power generation sector. This would be a critical factor to ascertain the sector-crediting mechanisms’ contribution to mitigating climate change. Box 6 illustrates the potential risk of free-riding in the case of power generation from non-fossil sources – and suggests that it may be useful to consider excluding *existing* zero-emitting sources from a sectoral crediting mechanism.

The role of any SCM within a future climate regime can also vary – and will be an important determinant of the environmental effectiveness of any SCM. For example, if no countries have binding emissions targets, there will be no rationale to create any SCM. As noted at the beginning of the study, a demand for credits that is generated by some binding commitments on at least some countries is a necessary precondition for SCMs. Similarly, if several key sectors are omitted from/not eligible to participate in a SCM, the GHG mitigation scope of such a mechanism will be limited – but may still be better than the current situation and better than without any SCM.

Box 6: The case of zero-emitting power-generation technologies and sectoral crediting mechanisms

The IEA's World Energy Outlook (IEA 2004b) projects that under a business-as-usual scenario, electricity generation by all renewable energies and nuclear power in developing countries will generate a total of 2174 and 380 TWh respectively in 2020 (i.e. representing 20% and 3% of their total power generation in 2020). If all this electricity production could generate credits under a sectoral crediting mechanism, it could result in significant levels of free-rider credits.

For example, a sectoral crediting mechanism for the power generation sector based on a worldwide³¹ rate-based GHG-intensity target of 350 or 500 tCO₂/GWh could result in the order of 0.9-2.6 billion credits³² in the year 2020 (or 5-16% of estimated Annex I CO₂ emissions in the same year). This assumes that all zero-emission electricity generation is eligible to generate credits. Using the same rate-based baseline assumptions but restricting any credit generation to the increase (i.e. excluding existing installations) in electricity production from renewable energy and nuclear power between 2002-2020 would generate 0.2-0.9 billion credits in 2020 (1.3-5.6% of estimated Annex I CO₂ emissions in the same year).

On the one hand, meeting the UNFCCC's ultimate objective may require providing incentives to zero-emitting technologies for their greater deployment. On the other hand, these technologies are already implemented to some extent under business-as-usual conditions and are thus a potential source of free-riding. The extent of such free-riding may be more or less significant depending on the stringency of the baseline and the eligibility criteria for SCMs.

It should be noted that "environmental effectiveness" is different from "certainty of GHG mitigation". The latter refers to the extent to which fixed emission levels (or reductions) are predictable in advance. "certainty of GHG mitigation" may be desirable from a policy perspective to justify mitigation efforts. The GHG mitigation certainty of non-binding targets/baselines, or of rate-based and policy-based mechanisms will be lower than that achieved with a binding fixed sectoral emissions limit. However, the overall environmental effectiveness may not necessarily be greater with fixed emission limits if these discourage participation and reduce baseline stringency compared to other alternatives.

Balancing participation, stringency and GHG mitigation certainty issues will be key in the design of any future sectoral crediting mechanism and to ensure its overall effectiveness.

3.2 Data requirements and availability

Reliable data are essential to developing baselines and to assessing compliance with emission commitments (binding or non-binding) and participating in emissions market-based mechanisms. The type and amount of data are likely to vary with different SCM designs. For instance, a broad SCM for some sectors may require more data than that needed for a project-based crediting mechanism, although this

³¹ A worldwide baseline is used for illustrative purposes only. Emissions baselines should be determined on a country (or grid) basis.

³² These figures are calculated using an example rate-based target of 350 or 500 tCO₂/GWh worldwide. For comparison, the average emission intensity of electricity production in non-Annex I countries has not been below 617 tCO₂/GWh since 1992 (when figures are first available, IEA 2004). Actual baseline rates for different countries are likely to vary, but most would be expected to be greater than 350 tCO₂/GWh – although this depends on the baseline calculation methodology.

may be counter-balanced with possibilities for greater economies of scale and lower transaction costs (see below).

In general, a sector-wide emissions inventory is a necessary condition to set a sector-wide emissions baseline. However, emissions inventory data is currently organized by gas and by source rather than by sector. For some sectors, information on more than one GHG or more than one emissions source may be needed. For example, cement production generates CO₂ emissions from on-site fuel combustion, on-site process emissions and from electricity generation (which could occur on-site or off-site). Several different types of emissions data may thus be needed to calculate a “sectoral” emissions inventory. Further, these sectoral inventories would only be comparable across countries if the same boundary definitions are used – e.g. whether or not to include electricity-related emissions when calculating emissions from the cement sector.

If targets are set at a sub-sectoral level, emissions inventory information would also be needed at this level. However, the availability of (sub-)sectoral emissions data may vary for several reasons:

- Ownership of emissions sources: data from publicly-owned companies may be more readily available than those from private companies;
- The number and size of emission (or sequestration) sources: monitoring a larger number of sources is more resource-intensive;
- Current practice or regulatory requirements: monitoring procedures and programmes set up for other reasons may be difficult to change. Such requirements affect the type of data monitored and when they are collected.

Regarding the latter point, if a sector-wide emissions inventory is only available periodically (not annually) it would mean that credits could not be generated, monitored or reported on annually – for example in the case of forest inventories. This may also make it more difficult to estimate in advance whether or not a sector will emit fewer GHGs than its emissions limit.

In principle, historical sectoral emissions inventories would be necessary for developing projections for either a sectoral baseline, but may not be sufficient. However, this data may also need to be supplemented by other information, e.g. on expected future activity levels, technological change, resource availabilities etc. In theory, baselines should be set at a level that encourages increased GHG-friendly behaviour while not swamping the market with credits resulting from an exaggerated baseline (i.e. generating surplus credits) and/or free-riding. However, this is not necessarily an easy task, given that the possibility to earn credits can provide inclinations to seek to exaggerate baseline emissions and/or to not be transparent on future government plans, and that wide variations exist in GHG-performance to produce a given product within a sector. Nevertheless, in some countries and sectors, projections of factors such as GDP, electricity demand growth may be carried out for other purposes and may provide a means to double-check claims on baseline projection). Further, data availability on factors influencing GHG emission performance may be “asymmetric” in some sectors. This will increase uncertainties associated with non-industry assumptions (e.g. by governments) on the type of technology deployment, rate of autonomous efficiency improvements etc. within a sector.

3.3 Costs of establishing and implementing a sectoral crediting mechanism

There are administrative costs associated with the development, implementation and enforcement of any policy instrument; sectoral crediting mechanisms are no exception. The costs of establishing and implementing different sectoral crediting mechanisms will vary according to the mechanism type, its

characteristics (e.g. whether or not it is binding), sector and number of participants. The European countries' experience with establishing National Allocation Plans for the EU-ETS has shown that detailed information is needed – sometimes at a site-specific and sub-sector level – in order to set sectoral emission limits. Such data requirements would have significant resource requirements.

To the extent that entities are directly involved in sectoral crediting mechanisms, they may incur transaction costs associated 'creating' emission credits. Different types of mechanisms and oversight structures could also result in different levels of costs at the international, national and entity level. The relative importance of costs for different actors may differ in the three crediting mechanisms examined in this paper. Costs would also vary over time, as is the case with other policy instruments – i.e. initial costs may be higher than operational costs. The benefits, in terms of, e.g., stimulating greater GHG mitigation through policies and investments, and lowering transaction costs may also vary.

Given the international nature of sectoral crediting mechanisms considered here, governments would need to devote resources and time to prepare, negotiate and obtain multi-lateral agreement on the form and timing of the sectoral crediting mechanism, and the level of the baseline.

Costs to implement a crediting mechanism may also be borne at the entity level. Indeed, the high transaction costs associated with developing CDM projects has become a common area for complaint amongst CDM project developers. For potential SCM types, however, entity-related transaction costs are likely to be lower. However, entities may still need to devote resources for participating in SCM (with fixed or rate-based baselines) if generating credits is calculated on the basis of data that is not routinely monitored – although potential economies of scale should be greater than with project-based mechanisms.

3.4 Competitiveness issues

Negotiations on any future climate regime have not even begun, so its eventual form and scope is unclear, as is the role of any sector-based crediting mechanism within it.

Concerns about loss of competitiveness largely arise in cases where industries in countries or sectors with a binding emissions baseline/limit are asked to assume a mitigation burden while their trading partners and/or competitors do not. The potential risk is that their mitigation efforts are undermined if production shifts abroad and thus result in no GHG benefit as emissions "leak" to other locations. As well as having competitiveness effects between different countries, binding emission limits could also have competitiveness impacts between industries (e.g. changing the relative competitiveness of steel or aluminium in the automotive industry) if only one of those sectors has emission mitigation obligations. Such concerns would be addressed through a broader coverage in a SCM (in terms of participation and countries). It is worth recalling that if SCMs could lead to a broader coverage of GHG mitigation, this would be a positive contribution as it would alleviate concerns about distortions of competition, from the current situation where large portions of industry worldwide are not covered.

Competitiveness concerns may be greatest for the internationally-operating industries (e.g. aluminium, steel, cement, etc.), as opposed to domestically-oriented sectors (e.g. power generation, buildings, etc.). The internationally-operating industries may in fact be best suited for trans-national crediting mechanisms which could involve internationally-set binding baselines that would apply to all facilities in all countries covered by the sectoral crediting mechanism.

4. Conclusions

Sectoral crediting mechanisms are a promising approach to achieve GHG emission reductions and to encourage increased participation and investment in GHG mitigation activities.

Three potential designs of a sectoral crediting mechanism are examined in this paper:

- **policy-based crediting**, where credits would be generated by adopting and implementing GHG-friendly policies in particular sectors;
- **rate-based (indexed) crediting**, where GHG emissions below a certain intensity level (e.g. per GDP or per product output) would generate emission credits; and
- **fixed sectoral emission limits**, where emissions “credits” could be generated if a sector or company emits at a lower level than an agreed limit.

These different design options for sectoral crediting mechanisms could operate on their own and/or with other GHG-mitigation measures. Also, these designs could be combined (e.g. a policy-based crediting mechanism with a rate-based baseline), as well as co-exist (e.g. one design could be applied to one sector, while another sector could be covered by another SCM design). Two distinct approaches can be envisioned for setting-up sectoral mechanisms at an international level.

- Trans-national sectoral mechanisms. These would seek to encompass companies operating in a given sector world-wide (or the majority of them). This wide reach would help to alleviate competitiveness concerns. A trans-national approach may be particularly relevant for the internationally-operating industries.
- national sectoral mechanisms. These would involve national governments proposing baselines for some of their sectors, as a means of providing incentives to exploit GHG-reducing opportunities by attracting GHG-friendly investments with sectoral emission credits.

Baselines for a SCM would need to be established prior to any credit generation. Establishing a SCM would therefore require projections of the GHG performance of policies (including the effects of existing policies) or sectors. It will also require defining what is a “sector” and its boundary. This may be easier in some sectors, e.g. electricity generation. However, other sectors, e.g. pulp/paper production, may need to be further disaggregated, e.g. paper production or tissue paper production. Further, sector-level baselines expressed in rate-based or absolute terms, may also require assumptions on other factors such as economic growth, relative exchange rates, infrastructure development, resource availability, etc.

Some level of international coordination and national management would be needed for any of the SCM structures examined in this paper. This would be needed both *ex ante*, i.e. to establish the form and scope of a mechanism, as well as *ex post* – to monitor and evaluate progress. However, the extent to which governments and the international community are involved in managing and overseeing a sectoral crediting mechanism would vary according to its structure and whether emission baselines/limits are binding or non-binding, although governments would remain responsible for their sector(s)’ overall compliance. For example, international coordination (rather than national-level oversight) could play an important role in a trans-national sectoral rate-based crediting scheme that applies across different countries, e.g. in sectors where multinationals account for the majority of production and emissions. However, national-level involvement is needed in allocating any emissions limit to entities in a national sectoral mechanism. Private-sector entities could be involved, depending on the design of the SCM.

The environmental effectiveness of a sectoral crediting mechanism in reducing greenhouse gas emissions would depend on many factors. These include:

- the participation of significant emitters (countries and sectors) in a sectoral crediting mechanism and/or global climate regime;
- the stringency of any national emissions targets and/or sectoral baselines;
- whether such targets and/or baselines are binding or non-binding; and,
- whether the international/national framework of such a mechanism leaves significant potential scope for free-riders and gaming.

There are administrative costs associated with the development, implementation and enforcement of any policy instrument; SCMs are no exception. The costs of establishing and implementing different SCMs will vary according to the structure, characteristics (e.g. whether or not sectoral baselines/limits are binding), sector and number of participants. These costs will be borne by governments and entities in different degrees, depending on the type of any sectoral crediting mechanism established. While some country-specific or sub-sector-specific factors may need to be taken into account, it may also be important to keep the structure of the mechanism simple and practical enough to allow it to be negotiated between all participating countries.

However, the development of a sectoral crediting mechanism could also face challenges. These include:

- data issues, as lack of data could constrain the sectors and/or countries in which different types of mechanisms could operate;
- the costs and time needed to develop and implement a detailed and wide-ranging SCM;
- the need to balance long-term signals to mitigate GHG emissions with the risk of significantly over or under-estimating baselines if these are projected a long time in advance;

Thus, several issues would merit further consideration before a sectoral crediting mechanism is taken forward. Further, it should also be recognised that any sectoral crediting mechanism would in all likelihood be only one of several means by which GHG emissions are targeted for mitigation. Expectations of the role of such a mechanism, and its potential impact on GHG emissions and their trends need to be realistic – and will be in large part a function of the demand for emission credits.

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