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**SECTORAL CREDITING MECHANISMS FOR GREENHOUSE GAS MITIGATION:
INSTITUTIONAL AND OPERATIONAL ISSUES**

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The ideas expressed in this paper are those of the author and do not necessarily represent the views of the OECD, the IEA, or their member countries, or the endorsement of any approach described herein.

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FOREWORD

This document was prepared by the OECD and IEA Secretariats in March-May 2006 in response to the Annex I Expert Group on the United Nations Framework Convention on Climate Change (UNFCCC). The Annex I Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. In a collaborative effort, authors work with the Annex I Expert Group to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the Annex I Expert Group. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

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Executive Summary

International climate policy makers face two issues: how to accelerate the deployment of technologies that advance sustainable development in developing countries and how to make the process of developing emission reduction credits under the Clean Development Mechanism (CDM) more economically efficient and environmentally effective. Previous AIXG papers (Bosi and Ellis, 2005 and Ellis and Baron, 2005) have explored issues relating to broadening the project-based approach of the CDM to a sectoral crediting mechanism (SCM) beyond 2012.

This paper builds on those efforts and focuses on sector-wide baselines, design and institutional issues, and questions relating to governance. It then analyses and compares various designs in terms of environmental effectiveness, economic efficiency, administrative cost/feasibility, and competitiveness concerns. The paper concludes that while it is possible to design a sectoral crediting mechanism to complement the flexible mechanisms contained in the Kyoto Protocol, a number of challenges would need to be addressed in a system seeking to move crediting to a sector-wide basis:

- The development of sector-wide baselines could prove very difficult as there is little homogeneity in sectors. Within a sector, wide variations in greenhouse gas intensities and among facilities may mean that differentiation, and thus multiple baselines, are needed. This is not necessarily conducive to a least-cost mitigation outcome overall. Further, it may be very burdensome to negotiate. Existing policies that apply to sectors also complicate baseline setting. For activities with internationally traded products, the possibility that “laggards” could be rewarded with GHG crediting may also be a barrier.

- The development of (sub-) sectoral baselines at either the national or international level will require institutions with technical skills capable of evaluating, monitoring and verifying sectoral crediting proposals. Many developing countries may not have the domestic institutional capacity (or data) to evaluate such proposals, and, if agreed, to turn them into effective domestic policy that would trigger expected GHG reductions. Similarly, international institutions would also need to evolve and be strengthened.

- The co-existence of SCM and other mechanisms (e.g. the CDM, which can include “programme[s] of activities”) while not impossible, must be clearly thought through. Co-existence of different mechanisms would also need to take into account countries’ respective capacity to adhere to one rather than the other mechanism, as well as methodological issues such as how to avoid double-counting of emissions credits.

- The role of industry would need to be carefully considered. For example, if an SCM involved setting a baseline at an international level, the limited membership/coverage of many international industry federations may restrict their role beyond the much-needed input to baseline discussions.

- Participation in a SCM may be limited unless accompanied by a signal from buying countries that increasingly stringent targets will be in place for a long period of time. In other words, the demand for credits must be relatively certain to make the effort worthwhile.

- As a SCM could in theory broaden the scope of creditable activities to non-Annex I countries’ domestic policies, the environmental effectiveness of the instrument must be secured. This could be achieved by e.g. not crediting all GHG-reducing policies or by discounting credits for policies that represent clear “win-win” opportunities.

This paper also notes that a SCM could offer a number of benefits because:

- SCM could be used by host governments in a number of ways to implement policies with broad economic and environmental development issues. Participating countries could use SCM to build capacity to that effect.

- Once a baseline is established at sector level and monitoring processes are in place, economies of scale would reduce the administrative costs of credit generation and approval compared to existing practice under the CDM.

Given the potential similarity between SCM and the CDM, particularly regarding “project activities under a programme of activities” (referred to here as PCDM), one way forward may be as follows:

- Build on the existing domestic and international institutional structures and methodological work of the current CDM to consider future expansion to sectors.

- Consider the promotion of an “experimental SCM at the national level” in the context of PCDM with the aim of learning by doing. Even a limited number of experiments by a few pioneering countries and industries would allow valuable information to be collected on the technical and institutional issues.

- Inquire whether any industrial sector would be willing to participate in an international SCM in the near future, under what conditions and with what level of participation. One option to do this would be for the Conference of the Parties of the UNFCCC to invite national and international industrial associations to provide comments on their interest in exploring participation in such an approach.

1. Introduction

This paper explores various operational and institutional issues for sectoral crediting mechanisms (SCMs) of three potential designs (policy-based, rate/intensity-based and fixed targets). It then analyses and compares these designs in terms of environmental effectiveness, economic efficiency, administrative cost/feasibility, and competitiveness concerns. In so doing, it builds on previous analyses carried out for the Annex I Expert Group (e.g. Bosi and Ellis 2005, Ellis and Baron 2005).

1.1 Definitions

Sectoral crediting, as outlined in this paper, is envisaged as expanding the coverage of the Clean Development Mechanism from a project-by-project level to a sector-wide level. More specifically, this paper considers sectoral crediting as a mechanism to *credit* reductions at the sector level: baseline emission levels/rates and certified emissions would be defined for a range of sources defined as a sector. The difference between the baseline emission levels and emissions from the sector would be credited through an international procedure. National governments or specific authorities would be designated to then allocate credits to individual sources, if appropriate.

As defined, SCM differs from a mechanism whereby an individual project could be credited on the basis of a sectoral baseline. In this latter case, emissions may increase elsewhere in the sector without harming the credits to the individual project. We assume that crediting under SCM hinges on the total emissions recorded by the sector.

If a country agreed to participate in a SCM for a particular sector/sub-sector, it would guarantee that a minimum proportion of emissions from that sector were included in the SCM. If the country remained outside an SCM, projects within that sector/sub-sector could still generate credits under the CDM.

Earlier papers have presented three broad options for sectoral crediting (e.g. Bosi and Ellis 2005). These options are:

- Policy-based. Sectoral crediting would occur based on GHG reductions occurring as a result of a well-identified policy. As distinguishing the effects of the policy from exogenous factors, this option could require a thorough ex-post evaluation of the policy's actual contribution to abatement. This option would nonetheless open the opportunity of crediting to activities and sectors that may otherwise not have access to carbon finance.
- Rate-based (or intensity-based). The baseline is defined as GHG emissions divided by a metric reflecting the sector's activity level (e.g. gigawatthours of electricity, tons of primary steel or aluminium, etc.) A sector would be credited if it managed to emit GHG at a rate below the agreed baseline. Quite simply credits would amount to the difference between the baseline and the observed rates multiplied by the level of output over the period.
- Fixed target (or cap-and-trade). A sector would become eligible to credit GHG reductions if emissions were below a fixed, pre-agreed quantity.

The three main options listed above share common features such as the need for reliable projections to establish a robust baseline, the proper definition of the sector covered by the mechanism (such as threshold values below which installations are not covered) and proper monitoring and verification mechanisms.

1.2 General considerations about sector-based crediting

This paper considers issues stemming from the potential implementation of sectoral crediting mechanisms for greenhouse gas emission reductions. An earlier paper already presented design issues that would need to be resolved when moving to an implementation stage, and illustrated options for design in the cases of electricity generation and aluminium smelting (Bosi and Ellis, 2005; Ellis and Baron, 2005).

Quite naturally, SCM would apply to non-Annex I countries only: sectoral crediting, to be successful, would require a high level of demand for credits. Creating a voluntary crediting mechanism open to all countries would generate much higher supply of credits, and lower demand. This raises a critical element in the overall success of a broad sector-based crediting mechanism. Arguably, SCM would only be introduced as a new mechanism if it was viewed as a promising means to mitigate GHG emissions from GHG-intensive sectors, activities with rapidly increasing emissions – like power generation, transport – and if it addressed competitiveness concerns in certain key industries. However, Ellis and Baron (2005) stressed that crediting may not be the best vehicle from that perspective, at least in sectors with globally traded goods, as they may imply rewarding financially those companies that have lagged behind in efforts to reduce their emissions, while early movers did not benefit from crediting. Such a situation is unlikely to ease competitiveness concerns.

Essentially a carbon market mechanism, SCM forces us to think about overall supply and demand for credits that may be forthcoming from its implementation. Table 1, below, illustrates the potential level of credit generation if SCM were making sector-wide reductions eligible for crediting. In the developing countries, the IEA (2004) concludes that 2.9 GtCO₂ reduction from the Reference scenario by 2030 is achievable, based on the implementation of policies currently under consideration by governments.¹ This level of emission reductions refers only to energy-related emissions (and e.g. excludes potential emission reductions in other sectors such as land-use change and forestry and agriculture, or other gases).

Table 1: Changes in CO₂ emissions from the Reference to the Alternative Policy scenarios

	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	-84	-251	-528
Total	-2 511	-561	-2 941	-6 013
Emissions in Alternative Policy scenario*	13 322	2 940	15 424	32 201

Source: p.379 and Annex A in IEA, 2004. *Excluding bunkers emissions

For instance, a policy-based SCM in just the power sector of developing countries could generate almost two billion credits per year in 2030 – provided all policies involved are deemed additional by the authority governing the mechanism. This compares to less than 40 million credits per year in 2010, also in the power sector, but generated by CDM projects (Ellis and Levina, 2005). Even accounting for expected growth both in terms of power generation and the CDM portfolio, it is clear that the level of credit generation by an

¹ At global level, emissions in 2030 could be 6 GtCO₂-eq lower than their projected level under business-as-usual if countries implemented certain policies under consideration.

SCM and the CDM could be different by orders of magnitude. SCM could indeed trigger significant GHG mitigation in developing countries – with policies that would largely bring economic benefits, and not costs, according to the IEA projections (IEA 2004).

This picture is not complete without assumptions on the demand side of credits. If a SCM is to contribute towards stabilising GHG concentrations, any quantitative emission commitments agreed would need to match such supply of GHG credits with equivalent demand. To be effective, the buying countries would also need to offer a price level high enough to encourage developing countries to undertake these actions. This represents a potential sea change from the current situation of excess demand for CERs, leading to a worry that supply may be lacking for the first commitment period of the Kyoto Protocol.

Arguably, not all such reductions may be credited under a SCM. Some countries may, between now and 2030, implement these measures without relying on incentives from the international carbon market. On the other hand, the crediting potential illustrated here does not assume carbon pricing policies: paying for carbon may there increase these GHG abatement estimates. The basic conclusion therefore remains: if SCM is to effectively curb emissions in developing countries, a larger demand for credits will be needed than currently projected.

1.3 Approach and outline of the analysis

Guiding policy choices requires a systematic comparison of options. In the case of a hypothetical policy instrument such as sectoral crediting – as narrowly defined in section 1.1 – such systematic comparison is difficult as different options may not be strictly comparable. For instance, not all options may be easily applied to a given sector (e.g. an intensity-based crediting may hardly be implemented to a government policy seeking to substitute public transport for personal vehicles); the policy-based SCM may be the only practical option in this case and comparison is therefore moot. Also, not all countries may have the institutional capacity to implement all three options at the same scale. Last, the ability of each option to deliver real reductions hinges on the “additionality” of the sector’s efforts and on the stringency of the baseline. Unfortunately, there is no universally recognised method to define additionality and to determine a baseline

This paper nonetheless offers some insights on how each potential SCM option may fare with respect to the following criteria:

- Environmental effectiveness: can this option trigger real reductions where implemented?
- Addressing competitiveness concerns.
- Administrative cost and feasibility: how demanding is the mechanism in terms of monitoring, review and, possibly enforcement policy?
- Economic efficiency: to what extent does the mechanism lead to the adoption of the least-cost mitigation options in the sector?

An initial assessment of each option along these criteria is provided in the conclusion section.

This paper explores potential SCMs along several lines. Section 2 draws lessons from existing mechanisms; section 3 considers several dimensions to be considered for baselines; section 4 discusses how SCM could be implemented to provide effective incentives to mitigation; section 5 explores international governance issues. Concluding remarks are presented in section 6.

2. Sector-based Crediting: Insights from Existing Trading Mechanisms

2.1 Emissions trading and CDM: a focus on large point sources

Experience with emissions trading mechanisms suggests that development of any SCM would be likely to focus on certain sectors. For example, choosing to include power generation, iron and steel, cement, paper and pulp, refining and other large combustion installations in the EU ETS can be explained by governments' wish to minimise administrative costs while covering as large a share of countries or regions' emissions as possible under one general policy instrument.²

The current exclusion of the transport and building sectors from trading schemes, except through offset programmes of fairly limited scope, is explained by other factors. Firstly, energy efficiency, in many cases the factor behind the GHG intensity of various end-uses, is not usually a primary determinant in investment and behaviour in these two sectors. Thus, an economic instrument such as "cap-and-trade" is seen as more suited to profit-maximising, cost-conscious firms than to householders or individuals. Secondly, emissions sources in these sectors are often small as well as very numerous, and therefore more difficult and/or costly to monitor³.

The majority of credits expected to be generated from the CDM has also focused on projects involving large point sources. Indeed, the large share of N₂O, CH₄ and HFC23 abatement projects is outlined in an accompanying analysis (e.g. Ellis and Karousakis 2006). As well as being able to generate large volumes of credits, such projects are also attractive because they require a relatively low total investment, are highly profitable as they mitigate GHG emissions at sometimes well below USD 1/tCO₂-eq (see e.g. Ellis and Gagnon-Lebrun 2004 which collects estimates for GHG mitigation costs from different gases/sources). The agreed environmental additionality of these projects is also an important factor. Being a crediting mechanism, SCM is likely to be guided by the same forces: a wide coverage combined with an accepted methodology to establish additionality.

2.2 Crediting: CDM is influencing sectoral developments in some countries

The incentives of the CDM to reduce emissions can have a clear impact on emissions and/or behaviour in selected countries and sectors. Perhaps the most striking example is in HCFC22 production in China. HCFC22 production generates HFC23 as a by-product – and HFC23 is a powerful greenhouse gas (with a global warming potential of 11 700). HFC23 emissions account for a small, proportion of China's GHG emissions, but production of HCFC22 (and consequently, emissions of HFC23) are growing rapidly. The CDM EB has approved a methodology to calculate emission reductions from existing HCFC22 facilities. In China, 7 of the 9 plants eligible to generate emissions credits under this methodology have – or are in the process of – doing so (Wei 2006). This is a very significant uptake of GHG-mitigation measures.⁴

² See IEA (2005) for a review of initiatives to establish domestic emissions trading mechanisms.

³ IEA (2005) presents options to overcome such barriers, e.g. by allocating the GHG burden to carmakers or fossil-fuel producers and importers, in the case of road transport emissions.

⁴ These projects are all to reduce HFC23 emissions in facilities that have been producing HCFC22 for at least 3y between 2000-04. The discussion underway at COP/MOP1 (to be continued at COP/MOP2) on the impact of the CDM on other environmental treaties, and the eligibility of new HCFC22 facilities suggests that crediting can also generate perverse incentives.

This is not the only example of the CDM's significant impact on a sector. In Mexico, there are several similar projects to reduce methane emissions from farms' manure management activities. Combined, these expect to reduce Mexico's methane emissions in this sub-sector by 3.5% compared to its 2000 value (WRI, 2006).

The CDM is also helping to increase electricity production from renewable energy sources in Brazil. This is particularly notable in the sugar industry, where bagasse waste is increasingly being used more efficiently. This is an important industry in Brazil, which is one of the world's largest producers and exporters of sugar (FAO 2005). In Brazil, there are currently 33 CDM projects under validation and/or registered that improve the efficiency of bagasse use in sugar mills⁵. There were 343 sugar mills at the end of 2004 (Schaefer 2006), so the number of more-efficient mills corresponds to almost 10% of the total.

However, the impact of the CDM on the GHG performance on other sectors in other non-Annex I countries is less compelling. While renewable energy and energy efficiency projects dominate CDM in terms of number of projects, their contribution to the projected GHG reductions from the mechanism is marginal, when compared to the power sector's projected growth in developing countries (Ellis and Karousakis, 2006).

Thus, although the CDM has had significant impacts on the emissions profiles of some sectors in some countries, it has not generally influenced emission trends in the major-emitting sectors such as energy and forestry. The limited impact of the CDM in these sectors creates a risk of locking in GHG-intensive production and consumption practices. A sector-specific approach would aim to facilitate access to crediting in certain sectors, selected for their strategic GHG implications.

2.3 Institutional arrangements: learning from the CDM

As well as setting up a mechanism by which to generate emissions credits and revenue, CDM "modalities and procedures" also include certain institutional requirements at the Secretariat, company, national and international level. At the international level, the EB supervises the CDM. The EB has established panels and groups to advise it on particular issues (e.g. accreditation, methodologies). At the national level, countries need to establish a "designated national authority" (DNA). The DNA's role is to approve CDM projects, although some DNAs undertake many other functions (see e.g. CAEMA 2003). At the company level, firms involved in the validation and verification of CDM projects need to be accredited. COP/MOP1 has also recently strengthened the role of the UNFCCC Secretariat in the CDM process, by asking it to draft recommendations and options for the EB and its panels.

Examining these different institutions and processes, and how they function, can also provide useful lessons for the establishment of a crediting mechanism at a sectoral level. For example:

- Setting up new institutions is time-intensive, and may require a new legal framework in a country – as well as inter-ministerial co-operation. Thus, several countries potentially active as either CDM hosts (e.g. Indonesia, Chile, Philippines) or investors (e.g. Sweden, Finland, Canada, Spain) took more than two years to finalise the establishment of their Designated National Authorities (Ellis et al 2004). Any SCM should, where possible, aim to use systems already built up for the CDM.
- Obtaining national-level approval for individual projects (e.g. letters of approval from DNAs) can also take a long time – particularly if this involves obtaining ministerial/cabinet approval. While developing an international framework and agreeing baselines for an SCM could be time-intensive,

⁵ A list of projects submitted for validation is available at <http://cdm.unfccc.int/Projects/Validation>

once a country has decided to participate in a SCM, obtaining national approval should be relatively simple – and a one-off procedure⁶.

- Methodologies developed to calculate emission reductions can be complex, and require significant amounts of data. In particular, different plausible baseline scenarios can lead to wide differences in expected emission reductions and credits, with a systematic incentive to inflate the baseline.

These considerations should be at the core of any feasibility study of a sectoral-crediting approach. If a sector-based approach offers the potential for a much broader coverage of emission-reducing activities, realising this potential hinges on authorities' ability to monitor and authorise the level of crediting that such mechanism implies, as well as on the international community's ability to negotiate a SCM (or to agree on procedures by which an individual SCM could be negotiated).

Table 2 indicates a few issues based on identified barriers to the CDM and how they may unfold under a sectoral-crediting approach.

⁶ However, there could be other complications with a SCM, such as how to distribute credits within a sector if some companies have "over-performed" and other companies have "under-performed". This issue is treated in section 4.

Table 2: Could existing barriers to the CDM affect sector-based crediting?

Barrier to CDM	Transposition to a sectoral crediting mechanism
Lack of project finance	Could SCM harness existing, domestic investment and growth in various sectors, while introducing an additional incentive to foster less GHG-intensive choices?
Lack of awareness of mechanism	How will a country that adheres voluntarily to a SCM translate such agreement into an effective signal at company level? This issue may be less prominent for a policy-based approach, where a government itself has designed the policy to trigger less GHG-intensive choices.
Low carbon price	Will the carbon market sustain price levels sufficient to trigger investment in GHG-friendly systems in developing countries?
Uncertainty on long-term future of mechanism/value of credits	This issue seems independent from any SCM itself. Rather, it hinges on Parties' emission mitigation commitments. The latter, however, are important to determine the magnitude of demand for credits that could be generated via SCM.
Data availability	This could indeed hamper participation of sectors/countries where historical data is unavailable, and where capacity is lacking to monitor and verify emissions among a large number of sources.
Transaction costs	The importance of transaction costs hinges on how the SCM is implemented by national entities, i.e., how effectively sources covered by the system can register their reductions and be credited.
Additionality	Determining how to assess "additionality" remains a contentious point in the CDM. Could SCMs circumvent this and also limit the level of free-riding?
Baseline setting/methodology approval	How could an SCM establish a baseline that is aggregated enough to ensure a feasible baseline approval process (at the national and/or international level), and disaggregated enough to provide a meaningful metric against which to generate credits?
Delays due to project-by-project approval	This depends critically on the system's design both at international and domestic level. If an SCM applies to all sources within a sector, project by project approval should not be necessary. An overall assessment of the sector's emissions – and underlying output – may be enough to gauge the level of crediting. The question under SCM then becomes whether any project-level review will be necessary, or whether a more global review process would suffice.

3. Baselines and Coverage of SCM: Operational Issues

How to set a baseline against which emission reductions are assessed and credited is a key operational issue⁷.

Policy-based crediting would require a detailed analysis of both the policy itself and on circumstances that may affect its effectiveness in reducing GHG emissions. While setting generic methodologies may be feasible for fairly standard policy options (e.g. the introduction of a standard for energy efficiency, a national ban on HFC23, or a policy to encourage to recover land-fill waste gas), determining what would have happened if the policy had not been put in place would remain a policy-by-policy exercise.

However, for industrial sectors that share fairly similar processes around the world, a more homogeneous, even international, baseline could be feasible. This section considers how baselines may be developed work under a sectoral crediting approach, in light of what SCM would seek to achieve: a wide coverage of a sector's sources bypassing a project-by-project approval procedure. The following discussion relates mostly to rate-based and fixed-target SCM approaches. A policy-based SCM would require a case-by-case baseline evaluation.

3.1 All-inclusive versus new plants baselines

The baseline level of a SCM is the reference from which crediting is established. This baseline level will be highly dependent on the sector's definition, and the nature of plants/installations/regions that are to be covered by the mechanism. A key question is whether or not a SCM should be create incentives for both currently-existing and planned new installations within a particular sector. Such a decision will impact the scope of a SCM, as well as its complexity. For instance, Ellis and Baron (2005) present various options to include new power generation plants in an SCM. New plants have access to newer, more efficient technology: an SCM covering new plants exclusively should naturally adopt a baseline that represents a step up from the performance of existing plants. Thus, existing plants and new plants should be assessed by different standards.

An alternative is of course feasible: all plants, existing and new, are included in the data set that will be monitored to assess the sector's performance, against a sector-wide baseline. The advantage of this all-inclusive approach is that it can cover all eligible sources, and create a broad-based incentive to lower emissions including through retrofitting of existing plants, hence enhancing the environmental and cost-effectiveness of the mechanism. Because a larger set of plants is covered, this approach, if effective, also reduces the risk of environmental improvements achieved in new plants being offset by, say, the deteriorating equipment used on plants outside the mechanism's scope. Whether or not the sector-level baseline would give a strong incentive for newcomers to adopt lower GHG-emitting technologies and for existing plants to retrofit hinges on the domestic arrangements – see section 4 – and, also, on carbon market conditions.

Another alternative (Ellis and Bosi, 1999) is to set different “benchmarks” for new facilities, based on the best available technology, and for existing facilities, i.e. an “existing technology benchmark”. This latter option could also be linked to technology financing and an assistance package which would take into account the sector's expected capital stock turnover (Schmidt and Helme, 2005).

⁷ Defining a procedure for how to assess/agree these baselines is an important institutional issue, and is explored in section 5.

Looking beyond environmental effectiveness, the obvious advantage of a new-plant-only approach is the much lesser administrative needs involved. Of course, its major disadvantage is that a SCM focusing on new plants only has a much lower scope – including in GHG- and/or energy-intensive industries where the lifetime of plants can be several decades, but the efficiency of current plants is low. The “case” for crediting would only require gathering data on such plants, leaving a myriad of older plants unchecked. Politically as well, the distribution of credits would be facilitated by having to deal with fewer interlocutors. In countries recording rapid growth in certain sectors, leaving existing plants outside the mechanism may be less of a concern if these represent a dwindling share of overall output and emissions.

3.2 National versus international baselines

Different approaches could be used to establish a sector baseline at international level.

Intuitively, a sector with significant product/process homogeneity ought to be a good candidate for an international-level baseline, i.e. a single baseline regardless of the new plant’s location. For instance, N₂O emissions from adipic acid production can be sharply reduced with a simple add-on to the existing process. The same is true for HFC23 emissions from HCFC22 manufacture. The baseline level could be established so as to make this add-on financially attractive. Alternatively, the baseline could be set as e.g. the recorded average N₂O emission levels for all adipic acid plants. However, cases where setting baselines are straightforward are likely to be few.⁸

Product homogeneity is sometimes taken as an indication that a single baseline may be appropriate for all new plants, regardless of their location. However, early analyses indicated that this may not be the case (e.g. OECD, 2000). This has been borne out with experience under the CDM where e.g. there are two approved methodologies for projects in the cement sector⁹.

Recent sectoral analyses on homogenous products also indicate variability in emission levels. For example, Reinaud (2005) indicates that CO₂ emissions per ton of processed crude oil vary between 0.2 and 0.36 t CO₂/t crude depending on differences in plant design and in raw materials (i.e. different types of crude oil). Plants with similar designs also display differences in CO₂ emissions per quantity of crude processed, suggesting further difficulties in setting a single baseline per process (see Table 3). Further, these intensities would vary from one year to the next, depending on the mix of output demanded by the market (fuel oil, diesel, gasoline, etc.).

The cement industry also relies on very diverse processes to produce a homogenous intermediate product (clinker). These variations are justified by local conditions (raw material characteristics, fuel availability) and can also affect a sector’s choice for a given technology. For example, METI et al. (2005) show how China’s limestone, with high moisture content, hinders the use of the more efficient dry kiln process. Furthermore, the low density of cement demand in China’s inner regions makes less-efficient vertical kilns more attractive. Such physical constraints must be taken into account. If these national circumstances are not taken into account when establishing baselines, it could make it extremely difficult for any improvements in a particular country or sector to generate credits. In fact, SCM on such basis would be of limited attractiveness in such cases.

⁸ The above-mentioned option of an all-inclusive SCM would preclude the option of a single baseline level across several countries: unless two countries feature old plants with identical processes and the same age distribution, the GHG content of their production cannot be identical, and neither can the countries’ baselines, for this particular sector.

⁹ For example, different methodologies have been developed for projects in the cement sector that switch from fossil fuels to alternative fuels, and for projects that increase the amount of low-GHG additives.

Table 3: CO₂ intensity of various refinery plants in Europe

Refinery types		1 000 tons of crude	Total ktCO ₂	tCO ₂ /tcrude
New	1-HSK	26 762	5 481	0.20
	2-HSK+VB+FCC	150 809	50 747	0.34
	4-HSK+VB+HCU	31 027	10 068	0.32
	5-HSK+DC+HCU	14 232	4 676	0.33
	6-HSK+VB+FCC+HCU	42 298	15 313	0.36
CEN	1-HSK	3 567	782	0.22
	2-HSK+VB+FCC	24 966	8 039	0.32
	4-HSK+VB+HCU	4 379	1 614	0.37
	6-HSK+VB+FCC+HCU	23 354	8 463	0.36
MED	1-HSK	31 233	6 473	0.21
	2-HSK+VB+FCC	105 740	34 692	0.33
	4-HSK+VB+HCU	9 840	3 238	0.33
	5-HSK+DC+HCU	2 934	971	0.33
	6-HSK+VB+FCC+HCU	76 698	26 559	0.35

HSK: hydroskimming; VB: visbreaker; FCC: fluid catalytic cracker, HCU: hydro-cracking unit, DC: delayed coker are various process units combined in crude oil refineries.

Source: Reinaud, 2005

Further, large variations in process-related emissions are also noted in aluminium production, both between and within different technology types. For example, Table 4 shows the variability of PFC emissions per tonne of aluminium for different smelting processes and the equally wide range of emission levels for each process, within each technology type. Looking at median plants, PFC emissions per tonne of aluminium vary from 0.36 to 10.3 tCO₂-eq between the highest and the lowest emitting processes. Further emissions levels vary by a factor between 3-11 for plants using the same process, between the 10% best and the 10% least performing plants.

Last but not least, sectoral fuel mixes may differ from one country to the next, which could lead to large differences in GHG-intensity for the same product made in different countries. Further, international and domestic fuel prices are bound to vary, which should in turn affect fuel choices in sectors participating in an SCM. The present experience suggests that forecasting such changes in relative fossil fuel prices and their effects on a sector's fuel mix is an illusory goal. Setting a precise baseline for a sectoral fuel mix seems an arduous task at best, while it is important to assess whether lower emissions have been driven by real efficiency gains or simply by a change in international energy market conditions. This is another area where a political, rather than a strictly analysis-based, decision would be necessary, and therefore another area of possible complication.

These observations tend to favour a relatively detailed approach to baseline setting, akin to industrial benchmarking in which local circumstances will very much affect the baseline. This is similar to the current practice under the CDM. The alternative would be an aggregate approach of several installations, where such differences would no longer matter. The central question in this case is how to create proper incentives for each and every installation to reduce its greenhouse gas emissions without also generating large volumes of "free-rider" credits.

Table 4: Ranges of PFC intensities of aluminium smelting processes

Process	Emissions of the median plant (tCO₂-eq / t Al)	Ratio 90th/10th percentile (2003 data)
CWPB	0.57	5
PFPB	0.36	11
SWPB	10.3	3
VSS	1.62	5
HSS	5.17	5

Source: Marks, 2006.

A common framework could nevertheless be created at international level, to ensure that a baseline covering all plants in a sector would be based on similar data and considerations. These could include:

- Threshold size for eligibility to the scheme (tons of steel or cement per day, installed thermal capacity for power plants).
- Base years used to measure past emissions and production levels.
- Best available technologies, and how the baseline ought to be set in relation with these.
- Percentage improvement from today's average emission levels / intensity defining the baseline.

These elements are not immediately relevant to a policy-based SCM approach: policies are heavily dependent on national circumstances, mostly as they answer a country's specific socio-economic needs and capacity.

4. Design and Institutional Requirements for Effective SCM

Existing project-based mechanisms provide, in principle, incentives to all GHG sources that may be eligible for either CDM (or JI) by nature of their activity and technology choices. With a high enough international price for avoided tons of GHG emissions, and with national institutions that effectively relay this price to project developers, project-based mechanisms could attract the interest of all these potential sources and trigger important levels of GHG reductions.

Sectoral crediting, as understood in this paper, is one option to leapfrog such evolution and provide incentives for mitigation on a broad sectoral scale. This section explores various ways through which sectoral crediting could encourage decision-makers at various levels to undertake GHG mitigation. The primary challenge is to convince individual plants to excel, while overall crediting hinges on efforts by all. This hints at the need for governments to be more involved under SCM than they are currently under CDM. This may be a non-trivial point in light of the efforts required to make SCM work.

4.1 Policy-based SCM

Government policies hinge on various priorities, budgetary and political constraints. Some socially and economically enhancing policies may not be implemented if they impose high transitional costs that cannot be properly alleviated – among such policies, some could lead to lower GHG emissions. Budgetary constraints may also hamper sound GHG mitigation policies – policies that may also bring significant ancillary benefits to the population. Last, policies specifically targeted to GHG reductions may not be accessible to countries because they lack access to project finance and carbon finance under existing mechanisms – although agreement at COP/MOP1 on the eligibility of programmes under the CDM has led some observers to infer that implementing policies may eventually be credited under the CDM.

Through the provision of additional funding, SCM could help governments to overcome these barriers. The following section explores how funding could help promote certain policies. We then point to the potential problem of policy-based SCM in dealing with the myriad of GHG-reducing policies and the level of crediting that this would trigger.

4.1.1 *How could crediting help policy implementation?*

Examples of non-climate policies with GHG benefits are numerous. There are also numerous examples of policy intentions that are not implemented, or policies that are enacted but not enforced. However, if credit revenues from a SCM could be channelled to those who can encourage and enforce GHG mitigation actions at a sector (rather than project-based) level, crediting could help to overcome barriers to effective implementation. In order to do this, it may mean that revenues from SCM credits are directed somewhat differently to revenues from CDM credits (which – until now – have accrued to the project developer; this may change with the implementation of PCDM). We offer a few examples of policies and how crediting could help implementation.

A country or region could decide to install solar water heaters in new buildings in a region, while this technology is not available domestically. SCM could be used to develop local architects' expertise, to pay any incremental cost over standard water-heating equipment, and to monitor policy implementation.

A government that has implemented electricity price controls for years and decides to bring prices to a more cost-based level may wish to implement energy efficiency improvements on the end-use side (e.g. via demand-side management) to smooth the effect on consumers' electricity bills. Given the expected

reductions in consumption and associated CO₂ emissions – at least in the near term – such policy could become eligible for crediting and revenues used to finance the demand-side management (DSM) programme (e.g., to subsidise the purchase of the most efficient appliances on the market or to install compact fluorescent light bulbs instead of incandescent ones).

Guéret (2004) illustrated how technical assistance could be used to promote the diffusion of energy-efficient appliances in developing countries, hence contributing to lower GHG emissions. Differences in the efficiency levels of electricity-using appliances between developed and developing countries suggest that higher standards in the latter could help promote reductions. Yet in some cases, countries are reluctant to implement such measures until their local producers are equipped to meet the new standards: some form of crediting could be used to bring local producers up-to-speed with more ambitious energy efficiency standards¹⁰.

The main question here is whether the promise of future credits is enough to secure upfront finance for all such activities? Certain policies would deliver credits with fairly high certainty, and therefore present limited risk from a carbon finance perspective, once other financing questions have been cleared – e.g. a programme for landfill gas recovery or HFC23 destruction¹¹. With little uncertainty on the level of earned credits, financing the incremental cost should be straightforward. In the future, mitigation options such as capture and geological storage of CO₂ from power generation may also offer relatively high certainty about the quantity of generated reductions. With a proper CO₂ price, SCM could be used to promote such technology, e.g. to mitigate the effects of growing generation costs on end-use prices.

As mentioned in an earlier analysis (Ellis and Baron, 2005), policy-based SCM would require a potentially lengthy and/or complex ex-post analysis of the GHG reductions delivered by a particular policy. While there may be more certainty in some of the above projects' ability to generate credits – renewables and solar water heaters substitute fossil-fuel energy and automatically displace CO₂ in certain countries or regions – more encompassing policies, e.g. the supply of public transport, may be more uncertainty-ridden. The question is whether governments need certainty on how many avoided tons will be credited to move forward with these policies.

It seems that overall an SCM can be designed so that credits accrue to a body able to encourage/enforce GHG mitigation activities at a wide scale. The following examples of how crediting could contribute to financing GHG mitigation policies are identified:

- Staffing policies that are not in a government's priority list for budgetary reasons.
- Establishing the feasibility and effectiveness of a measure, necessary to trigger proper support among local stakeholders.
- Covering the incremental cost of GHG-reducing equipment.
- Offsetting the transitional social or economic cost of a policy.

¹⁰ A potential for significant improvement exists in the electricity consumption of air-conditioning units in Southern regions of China, in light of the efficiency levels achieved in equipment sold in Japan (Koizumi, personal communication, 2006).

¹¹ An HFC23 burner would cost about USD3 million. HFC23-reduction projects under the CDM expect to generate between 1.4-6 million credits a year, equivalent to an additional income of USD 14-60 million, if credits are valued at USD 10/tCO₂-eq.

What remains uncertain is the financial market's ability to transform the forecasted emission reductions and the expected credits into appropriate funding at the early stage of the policy, where barriers may need to be overcome and start-up costs would matter. Maintaining sufficient incentives for project developers to pursue this route, rather than the CDM, is also important.

4.1.2 Should all reductions from all policies be creditable?

Two categories of policies can be distinguished for potential eligibility under a sectoral-crediting approach:

- Policies that are only justified by the need to reduce greenhouse gases, such as decomposition of industrial waste gases such as N₂O and HFC23, PFC abatement measures in the aluminium sector, to name a few.
- Policies that are promoted by governments for reasons other than GHG mitigation but that do contribute to lower emissions as secondary benefits. Sustainable development policies and measures (SD-PAMs), defined as policies aligning climate change policy with countries' development objectives, would fit in this category (Bradley, Baumert et al. 2005).¹²

Arguably, it would be more straightforward to determine baselines and additionality for the first category. Again, this has been borne out by experience under the CDM. The second needs closer scrutiny, however. Winkler and Baumert (2005, p.21) argue that "additionality assessments in the context SD-PAMs would be virtually impossible" as these policies would be implemented for non-climate reasons. They propose that creditworthiness be based on a list of policies that are "unquestionably climate-friendly [...] regardless of the motivation for enactment." Alternatively, CDM experience points to the identification of barriers as an approach to test the policies' additionality. The previous section illustrated instances where crediting could help remove barriers to the implementation of sound policies.

Yet there is a wide range of energy efficiency and other GHG-reducing policies that countries have put in place in the past and will continue to implement in the future without having benefited from access to the carbon market (see Wang, 2006, for a survey of energy efficiency policy in China's industry, and Wei-Shiuen and Schipper, 2005 in the country's transportation sector). This argues against crediting similar policies if they were to be undertaken in other countries, unless a clear case for additionality can be made.

In light of the improvements brought by such policies, should all reductions be credited to the host country that promoted this policy in its self-interest? There is of course no definitive technical answer to this question. Yet the question arises because the large scale crediting arising from the implementation of a win-win policy would allow emissions to rise in other parts of the international emissions trading regime.¹³ While this is a tenet of emissions trading, systematically crediting sound policies undertaken in countries without country-wide commitments could limit the global GHG mitigation effort. Along these same lines, Baumert and Winkler (2005) argue that "reductions of this scale might overwhelm the demand from industrialized countries, or otherwise dampen incentives in those countries to continue abatement efforts."

¹² "SD-PAMs are qualitative in nature and are clearly distinguishable from quantitative approaches to climate protection such as emission targets and the Clean Development Mechanism. However, it may be possible or even desirable to connect the pledged actions to these and other quantitative approaches in order to harness the potential benefits of the international carbon market." Baumert, Winkler, 2005.

¹³ Yamagata (2004) proposed to simply halve the quantity of credits to take into account, in a rough fashion, the possibility of credits accruing to reductions that would have taken place without the CDM.

One possibility to limit such risk is to discount credits for policies that bring clear local economic, social and environmental benefits, while recognising that carbon markets have helped overcome barriers to their implementation. Put differently, the policy baseline would not be a business-as-usual scenario, but set at a lower level, reflecting the country's own interest in moving forward with the policy's implementation.

4.2 Encouraging reductions based on intensity targets

In theory, an intensity target should deliver a fairly effective signal to sources in the targeted sector: achieving an intensity level that outperforms the set target should be rewarded by credits matching the source's effort to be beyond the baseline¹⁴. However, this logic does not automatically hold true under SCM. Sectoral-crediting needs to be relayed by specific domestic measures if sources in the sector under consideration are to receive the full incentive provided by the crediting mechanism.

One limit of the CDM is that some of the efforts made under one or several CDM projects within a sector can be outweighed by other players' investment in less efficient technology. SCM based on an intensity target could surpass the CDM from that perspective by an extension of its scope to all eligible plants in the sector. This would of course require an adjustment in the baseline, as an average performance would take into account the performance of all plants in operations when the baseline is defined.

If a country wants to access a bigger scale of credit revenues, and if SCM is to be an *alternative* to the CDM, a country would have the possibility – but not the obligation – to adhere to sectoral crediting. In that case, once the region of implementation is defined and agreed (country as a whole or not), crediting is done on the basis of all activities in that area, presumably for new and existing plants – which could benefit through an incentive to improve performance via various retrofitting options and, possibly, the closing of less efficient plants.¹⁵

The obvious barrier to the effectiveness of such a scheme is the possibility that some sources do not respond to the incentive, or that existing plants' performance deteriorates as capital stock ages, and therefore undermine the country's crediting opportunities. Arguably, this is not a problem for some sectors and countries where all assets are in the hands of a single actor – as is the case of certain government-owned utilities. It would be in the owner's interest to encourage improvements throughout its assets.

In other cases, however, effective policy should relay the signal provided by the international carbon markets to all sources. Options for this include:

- Mandating and/or subsidising energy efficiency and greenhouse-gas audits in existing plants. If done properly, audits could lead to decisions to retrofit and bring further reductions. Plants that are reluctant to implement recommendations coming out of the auditing process would need to justify the lack of response.
- Moving towards a fully-fledged, intensity-based emissions trading system. All companies/plants would be required to make improvements in line of the sector's baseline level agreed at international level (i.e., an x% reduction in GHG intensity by a given date). Alternatively, the government could credit all plants that have improved their performance while those with deteriorating performance would be financially penalised.

¹⁴ However, it could be very difficult to set a meaningful intensity target at a sector-based level for sectors in which there is significant variation in GHG intensity, e.g. forestry, chemicals.

¹⁵ The treatment of plant closure under emissions trading has received some attention in the context of the EU ETS. See IEA, 2005, chapter 3 for a discussion of this issue.

The above would require significant administrative capability – not unlike the framework of the EU emissions trading scheme, although industrial output is not part of the compliance assessment under the EU ETS. In the case of SCM, however, a country could decide to “opt in” for one (sub-) sector, if this were to match its capacity to collect the data and monitor implementation.

4.3 Fixed-target SCM: implementation challenges for developing countries

A fixed-target SCM may be the most challenging of all three SCM design options, even if it could be less demanding in terms of monitoring and review. Indeed, an intensity-based approach requires data on both emissions and output, while reporting on emissions would be enough to check compliance in a fixed-target approach. This option is nevertheless challenging as it combines both the textbook version emissions trading – caps are, in theory, backed by penalties – with a non-binding target applied to a sector:¹⁶ in effect, a country/sector committed under an SCM is not obliged to deliver reductions below target. Instead it is offered the possibility for such reductions to be retributed through the international carbon market.

SCM based on fixed targets should deliver a fairly effective incentive to reduce emissions, if one critical condition is met: a domestic scheme should devolve the cap to individual sources. Such schemes are usually backed by a domestic penalty for non-compliance. Note that the treatment of “non-compliance” is not explicit in existing CDM arrangements even though some agent along the chain between the project and the user of CERs for compliance must carry the risk of non-delivery of CERs. It is difficult to assess whether mechanisms in place to insure against such risk in the CDM could be put to use when moving to a much larger scale under SCM.

As is the case in the rate-based option, free-riding is the major impediment faced by governments adhering to this option - how can individual sources be convinced to invest in emission-reducing activities if other sources can annihilate all prospects of crediting? How can domestic arrangements make up for this fundamental shortcoming? The obvious theoretical answer is to apply individual caps adding up to the agreed, non-binding sectoral cap. If individual caps are strictly enforced, this system guarantees to sources reducing emissions below their caps that they will be credited via the possible sale on the international market. Most developing countries lack the institutional capacity to enforce such a domestic regime.

In addition, experience with emissions trading shows the importance of accounting for new installations, i.e. new potential sources. Caps ought to be allocated in a way that allows for growth in the sector – presumably, in an initial stage, the absolute cap would be growing in time. However, it would be anti-competitive to reserve all growth potential to existing plants. New entrants reserve, as implemented under the EU emissions trading scheme, would be needed here as well. How should, then, this growth reserve be allocated to give a proper GHG reduction incentive? Granting allowances on a first-come first-serve basis does not bring such incentive. The obvious response is to set a baseline that encourages installations to adopt a technology that is near the best available technology. Any new entrant proposing to install production capacity with lower emissions per unit of output could be granted allowances set at the baseline level and therefore own credits encouraging its higher performance. Sources in the opposite situation would be granted an identical quantity of allowances but would need to acquire allowances from other sources in the system, or on the international greenhouse market.

Similarly to new entrants, plant closures raise the question of crediting reductions as a result of interrupting or ceasing activity. While this may be due to the shift to, or competition from, a more efficient plant, there is also the risk that emissions have been moved to a location outside the regime, leading to carbon leakage. Increased emissions elsewhere would partly offset reductions achieved by the SCM.

¹⁶ See IEA, 2002 and 2005 for a discussion of non-binding targets.

Thus, there is no essential difference between the above description of a fixed target and what is observed in some of the EU national allocation plans. While experience exists that could be of use towards the implementation of fixed-target SCM, developing countries' willingness and ability to implement such a domestic system remain to be seen. With the potential danger of over-allocation as a way to encourage participation, this option presents a trade-off between two concerns: acceptability for non-Annex I countries and environmental effectiveness. This is a serious challenge for the feasibility of fixed-target SCM.

5. International Governance Issues

How a mechanism is governed impacts the ease (or otherwise) of participating in a mechanism. The governance of SCMs can therefore affect their level of uptake – and thus of credit generation. Selected governance issues are discussed in more detail below.

5.1 “Approving” SCM baselines

Agreeing a process by which to approve baselines needed for SCMs is a key issue: how the baseline is defined and what its level is will determine the number of credits a country/sector can generate. Potential “host” countries for the SCM have the incentive to set as high a baseline as possible, in order to generate more credits (and associated revenue). Some sort of international oversight and/or approval of the baseline-setting process is therefore necessary in order to ensure that baselines are plausible¹⁷.

5.1.1 *Defining and selecting sub-sectors*

If credits from SCMs are to represent improvements in GHG performance, many different baselines may need to be defined and agreed. This is because there can be significant variations in raw materials, product output and GHG-intensity (and limited inter-changeability of such products) within a sector, as well as significant differences in production processes and fuel mixes used to meet energy/electricity demands. For example, production of tissue-paper is twice as energy-intensive as that of newsprint (Lazarus et al 1999) and primary production of aluminium is many times more GHG-intensive than that from scrap (Watson et al 2005). The chemical industry is also extremely diverse, and the energy efficiency of important intermediate products such as oxygen, chlorine, ammonia, ethylene can vary between 2-68 GJ/ton (Worrell et al 2000 – data for the US¹⁸).

Thus, developing a single sector-wide baseline, although desirable from a simplicity point of view, could lead to significant errors and may not provide adequate incentives to invest in GHG-friendly technology. This has been widely described elsewhere (e.g. US DOE 2001), with analysis suggesting that “benchmarks” be developed at a more disaggregated level, e.g. at the process level within cement manufacture (Ruth et al 2000). It is thus more likely that developing baselines at the sub-sectoral level would be more appropriate. However, as previous analysis has shown (Ellis and Baron 2005) even defining a sub-sector is not necessarily straightforward.

5.1.2 *Developing and monitoring baselines*

Once a sector (or sub-sector) has been defined, a baseline would need to be established for this sector. However, this could be a very resource-intensive process – irrespective of whether the baseline is defined at the policy-level, in rate-based terms, or as an absolute cap. This is because of the sheer number of baselines needing to be developed up-front if several countries and sub-sectors are involved, and if the baseline level varies with each. For example, the Dutch benchmarking covenants developed for energy-intensive industries, involved setting benchmarks for 528 different processes and required input from 49

¹⁷ In the CDM, this international oversight is carried out by the CDM EB with help from its Methodology Panel.

¹⁸ Further, the energy intensity of individual products can vary substantially depending on which raw materials are used (e.g. the energy intensity of ethylene made from a naphtha feedstock is 60% higher than that made with an ethane feedstock, ABB - undated).

different consultants (Iestra 2005). Some, particularly in non-Annex I countries, may question the utility of spending scarce resources on developing sectoral baselines – some of which may never be used.

Data requirements would vary depending on the design of the SCM, and on the coverage of the sector. Monitoring requirements for baselines would therefore also vary accordingly.

5.1.3 Reviewing and verifying baselines

Reviewing and verifying SCM baselines may also prove challenging – at the policy, institutional and technical level.

Unlike in the CDM, host country governments would be much more involved in developing and negotiating SCM baselines, adding a political aspect unlikely to facilitate reaching agreement. This is exacerbated by the technical nature of baseline development. For example, some body may need to assess whether a country's underlying assumptions on technology penetration rate, demand growth rates, fuel availability and prices etc. were appropriate or not. This is much too detailed and technical an issue to be done at the level of multilateral government negotiations – particularly if it is required for many countries and sub-sectors. However, it is difficult to imagine that countries would agree to participate in a SCM without knowing what the corresponding baseline level was – both for them and for other potential “host” countries.

5.2 Ensure smooth links to existing mechanisms

If established pre-2012, a SCM would be the fourth mechanism by which emission reductions could be traded internationally¹⁹. If established post-2012, there would still be potential overlaps with an SCM and expected credit generation from CDM projects approved pre-2012²⁰ – as well as any post-2012 emissions trading schemes.

In either case, it is crucial that implementing a SCM does not disrupt the functioning of these other mechanisms. It is thus important that:

1. Clear distinctions are drawn between the different mechanisms, and guidance provided as to when an activity is eligible under which mechanism e.g. under the CDM or under a SCM. This should help reduce the risk of double-counting.
2. Clarifications are provided on how/if already-existing CDM projects could co-exist in a country/sector subsequently participating in a SCM.
3. Countries pursuing a SCM route, no longer approve new CDM projects in the same sector.

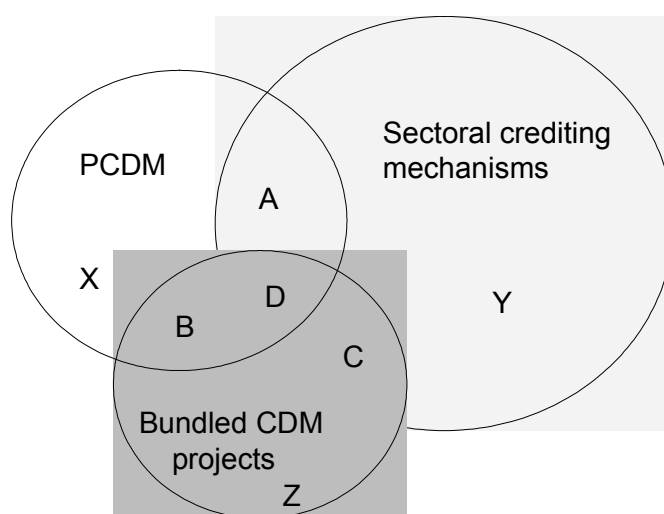
At present, it is not clear how a distinction could be drawn between some types of SCM, and between the provisions for PCDM and bundles of large-scale CDM projects agreed to at COP/MOP1. Figure 1 illustrates the potential overlaps between bundled CDM projects, PCDM and SCMs. The potential overlap is particularly marked for any SCM established at the national, rather than international, level. For example, if a company that dominated a sector's emissions in a particular country decided to initiate a

¹⁹ Such trading could take place outside the Kyoto Protocol, or inside the Kyoto Protocol, e.g. if the provisions on programmatic/bundled CDM were assessed as covering whole sectors or sub-sectors.

²⁰ CDM projects can opt for a crediting period of 10 years, or up to 7 years renewable up to two further times. Thus, several CDM projects approved during the first commitment period may expect to generate credits post-2012.

voluntary programme of emission reductions, and obtained credits from this, it could in theory be done under either the bundling or PCDM provisions in decision 4/CMP.1, or potentially under a sectoral crediting mechanism (area D). Alternatively, many (or all) projects in a particular country and sector could decide to undertake CDM activities, and present this as a single, bundled, project activity (area C). A programme aiming to reduce emissions from different activity types within a single sector (e.g. increasing the energy efficiency of cement production and increasing cement blending) could also potentially be eligible under either the PCDM provisions, or a SCM (area A)²¹.

Figure 1: Potential overlaps between bundled CDM projects, PCDM and sectoral crediting mechanisms



Helme (2005) suggests a way to deal with CDM projects that occur in sectors covered by an international “sectoral pledge” but that would take place in countries outside it. In such cases, the energy-intensity benchmark developed for the sectoral pledge would become the minimum threshold for CDM baseline in new facilities. The difference between a country that chose to remain outside the pledge and others would be its ability to propose individual projects under the CDM. In countries under the “sectoral pledge”, credits would only accrue if sources were, on average, operating under the pledge’s baseline intensity.

In theory, imposing a more stringent baseline for CDM projects following the establishment of a sectoral pledge would therefore foster countries to adhere to the sector-wide approach – or at least not encourage them to remain outside. However, the solution of a more stringent baseline under CDM does not recognise that countries may also face real barriers to participation in a sector-wide approach – limited capacity to monitor and review all sources – and that these countries may also be the least able to access the technologies allowing to beat the more demanding CDM baseline.

In summary, if a risk existed of a country playing strategically to maximise credits through CDM, rather than SCM, Helme’s solution of the sectoral baseline setting a minimum baseline for all CDM projects in

²¹ There could also be programmatic/bundled CDM projects that cut across different sectors. For example, a programme to reduce the GHG-intensity of transport within a city could involve increased production of biofuels, reduced consumption/distribution of fossil fuels, and construction of dedicated roads/rail. This could change the emissions profile of the forestry, oil and gas production, construction and transport sectors within a country, and so would be represented by area X. Similarly, one company could take GHG mitigation actions in several different sectors, and bundle them together as one CDM project. This would correspond to area Y.

the sector may be effective. But a country's capacity to move from a project-by-project approval process to a more systematic sector-wide approach should also be taken into consideration.

5.3 Setting an international baseline or best practice: what role for industry?

Various international initiatives indicate some industries' willingness to share information among companies and sometimes coordinate on best practice to reduce GHG emissions associated with their processes (for instance: WBCSD, 2002; IAI, 2004). Structured industrial fora and federations could provide valuable interlocutors to Parties as they seek to establish SCM in specific sectors. Indeed, in order to set a baseline, governments would need industry's input on current performance, existing best practice, best available technologies, costs, and the industry's overall international competition conditions. Some governments have acquired this knowledge in the process of setting benchmarks with industry, but this may be the exception rather than the rule, especially in developing countries. As a counterexample, China has recently established fairly detailed goals for heavy industry, expressed in energy use per unit of output for steel, aluminium, copper, some petrochemicals, cement, glass and ceramics (Wang, 2006).

In theory, international industry federations, when they exist, could play various roles in SCM²²:

- They could provide a forum for negotiation of appropriate best-available technologies among its members, and negotiate on behalf of the industry as a whole.
- Federations may be able to monitor and report on members' achievements, with support from certified auditors and expert reviews mandated by the COP or other international authority. This may be useful for countries where environmental reporting and review capacity may be lacking.
- If a single baseline or approach were agreed between Parties and an industry, its federation could take it on itself to translate them into disaggregate objectives, down to the company level in various non-Annex I countries. However this presumes that these countries' governments would agree to let an international industry federation establish GHG rules for installations on their territories.
- Last, but probably less likely, greenhouse gas credits could be attributed to an international industry federation based on its non-Annex I members' overall performance against the baseline. Credits would then be apportioned among sector participants, under the "jurisdiction" of the federation. Industry federations have not, to our knowledge, played such an executive role in the past. In addition, non-Annex I governments would become simple observers in a crediting process even though this would eventually affect their GHG balance.

The federation's roles presented in the first and second bullets seem reachable, provided they represent an important enough share of the sector's GHG sources. The last two may, however, be beyond what federations' members could agree. Governments' involvement would remain necessary in the appraisal process of SCM. This simply recognises that each producer operating in a country is first and foremost subject to this country's industrial, environmental and other regulations.

²² It may not always be the case, however, that federations cover a significant enough share of an industry, and even less so of non-Annex I producers – although many multinationals headquartered in Annex I countries own companies in non-Annex I countries. In contrast with iron and steel, and aluminium (International Iron and Steel Institute – IISI – and the International Aluminium Institute – IAI) the cement industry is not organized does not have an international association where such matters can be taken up.

According to Schmidt and Helme (2005), “international law has no clear precedents for regulating specific industries on a global basis. In situations where a single industry is dealt with in an international treaty (e.g. ICAO, WMO), the UN agency develops standards but relies on individual countries for their adoption and enforcement.” (page 3). On this basis, the authors argue in favour of a sectoral approach based on countries’ commitments. In addition, a limited number of countries could represent a critical mass in any sector, necessary to alleviate concerns about distortions in competition.

5.4 Competitiveness concerns: could international SCM help?

Earlier papers have touched on competitiveness issues in the context of climate policy (IEA, 2005; Reinaud, 2005). Focussing on SCM, Ellis and Baron (2005) mention the problem of “rewarding laggards” through SCM. Would an international SCM help alleviate competitiveness concerns or aggravate them?

Our basic assumption in this paper is that SCM would seek to enhance crediting options in developing countries and the transfer of best practice in regions where GHG concerns have not reached industrial decision-makers on a broad scale, or where policy signals do not exist to encourage such uptake.

If successful, SCM would result in financial transfers towards industrial installations in otherwise uncapped countries, in retribution for implementing mitigation measures or energy efficiency improvements that others may already have pursued without such retribution. At a global level, plants could then be facing one of three situations:

- A fixed cap on emissions, translating into a cost of emitting GHG above this cap. Improving GHG performance then becomes part and parcel of the usual source’s cost-minimising approach, and another necessity in order to remain competitive at international level.
- The opportunity to be credited for improving performance, if the source operates in a sector and a country that have adhered to a sectoral crediting mechanism. The SCM should generate additional revenues for those sources that have the possibility to “beat the baseline”, i.e. those that have not performed as well as others in the sector.
- No constraint or opportunity vis-à-vis GHG emissions abatement.

Would entities in the second situation be granted a significant competitive advantage through revenues from sectoral crediting? This hinges of course on the magnitude of achievable GHG reductions, the international price of carbon, and the stringency of the baseline. Arguably, an industry worrying about granting an unfair cost advantage to the “laggards” in the sector should promote an ambitious baseline, as near as possible to best practice. This would minimise the quantity of credits generated by plants that moved more slowly to implement these improvements and, with it, the cost advantage granted to them by the SCM. This solution is obviously not entirely satisfactory if one seeks to encourage more, rather than less, mitigation measures in developing countries. On the other hand, a policy that subsidises the competition to make changes that have been implemented elsewhere at net costs may not find broad constituency at the industry level.

This reinforces the view that sector-based crediting may not necessarily be an appropriate way to promote GHG reductions in sectors where competitiveness concerns loom large. Other sector-wide approaches ought to be explored in such cases.

These issues may be less prominent in policy-based SCM, if they apply mostly to domestic-based sectors (buildings and transport), where competition concerns are generally nonexistent.

Overall, however, negotiating country-specific baselines for internationally traded commodities and awarding credits for good performance without penalising underperformance may run against international trade rules, and generally be a difficult concept on which to reach international consensus. At least, the negotiation of international baselines would need to involve competition authorities so as to avoid going against existing trade rules.

6. Summary and Conclusions

This paper explores several operational and institutional issues for sectoral crediting mechanisms of various designs. In theory, sectoral crediting mechanisms could be a promising means to encourage investment in GHG-friendly systems, thus increase the level of credit generation and quicken the pace of clean technology uptake in developing countries. Nevertheless, there are some significant issues that would need to be resolved before any SCM could be developed.

1. Ensure a SCM provides effective incentives for GHG mitigation

Moving crediting to a bigger scale could reduce transaction costs in the approval process of credits, once the baseline is agreed. The operational issue for domestic governments seeking to maximise crediting is one of capacity to transform an international signal (i.e. a carbon price) into an effective domestic mechanism to all eligible sources.

2. Ensure environmental effectiveness of SCMs, in light of projected GHG reduction opportunities in developing countries

The potential generation of credits by SCMs could dwarf that under the CDM. For example, more than 3 GtCO₂-eq of credits could be generated in 2030 by the energy-sector alone if policies currently under consideration by governments were implemented and were deemed eligible for crediting. If a SCM is to contribute towards stabilising GHG concentrations, any quantitative emission commitments agreed would need to match this potential level of credit generation with (at least) equivalent demand for such credits.

3. Establish a simple system that generates meaningful credits.

One of the biggest challenges in developing a SCM is likely to be designing a system that is feasible to negotiate and set up, while also being environmentally effective. Over the last several years, many analysts have explored the possibility of establishing sector-wide baselines in different sectors. A common finding is that some differentiation will be needed within sectors in order to take into account variations in raw materials, product outputs, manufacturing processes, resource availability and fuel mixes. Distinguishing between new and existing plants may also be needed. If these variations were not taken into account, a SCM would generate many credits – but little environmental benefit.

For a limited number of sectors, it may be feasible to establish a baseline at an international level (i.e. one level, or formula, that could hold for many countries). However, this is likely to be the exception rather than the rule. It is an open question as to how baselines for many different sub-sectors in many different countries could be established, agreed upon and verified. However, some level of international oversight and governance is needed. As in the case of the CDM, it would be in a country's interest to establish as high a baseline for a SCM as plausible in order to maximise credit generation and revenues.

Table 5 offers a review of the three main options for SCM along the criteria announced in introduction (environmental effectiveness, competitiveness concerns, administrative costs and feasibility, and economic efficiency). As sector-based crediting is theoretical at this stage, and each option cannot hence be defined with much precision, this overview does not allow a ranking of options. Rather, it attempts to summarise how some of the above issues would materialise in each SCM option and affect its performance towards emissions abatement. Also, some of the criteria used here are clearly linked: administrative costs may limit the scope of an SCM and therefore reduce both its environmental effectiveness (ability to trigger significant reductions) and cost-effectiveness (ability to bring reductions at least cost). Drawing all such implications is beyond the scope of our analysis.

Table 5: Summary comparison of the three main options for SCM

	Policy-based	Intensity-based	Fixed target
Environmental effectiveness	Depends on baseline stringency.	Depends on baseline stringency.	Could be weakened by difficulty to accept fixed emission targets in developing countries.
Addressing competitiveness concerns	<p>Not applicable, when policy-based SCM is applied to “domestic sectors” (transport and buildings, for instance).</p> <p>For activities competing internationally, this depends on the stringency of the baseline and the potential gains for credited participants: will participating in a SCM confer a competitive edge, in light of costs incurred by competitors where carbon constraints are in place?</p> <p>If the mechanism credits participants for reduction measures already taken in other countries under “business-as-usual” circumstances, SCM could add to, rather than solve competitiveness concerns stemming from international climate policy.</p>		
Administrative cost and feasibility	<p>The mechanism can be tailored to fit a specific policy, and a government’s ability to implement and report on a policy’s achievement.</p> <p>This option does require a more thorough analysis, ex-post, of reductions actually triggered by the policy and not by external factors.</p>	<p>Monitoring emissions and some indicator of a sector’s output can prove costly and technically arduous.</p> <p>The feasibility test for this option will lay in the ability to define and agree to a single baseline for sector as a whole.</p> <p>Data gathering and verification to establish credits would still be costly. Further, managing the ex-post allocation of credits among various sources will require setting precise criteria. Enforcing a baseline to avoid sources increasing emissions while others undertake mitigation could prove particularly difficult. This is crucial to the system’s environmental effectiveness.</p>	Fixed targets require specific provisions for the inclusion of new emission sources and plant closure.
Economic efficiency	Hinges entirely on the specific policy design, its coverage of sources and ability to arrive at least-cost reductions in the considered sector.	Depends on the ability to implement baselines that encourage as wide improvements as possible. The multiplication of baselines for a given sector could discourage more radical process changes that could deliver more reductions at least cost.	May be high or low, depending on the extent that free-riders are effectively discouraged.

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