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SECTORAL APPROACHES TO GHG MITIGATION: SCENARIOS FOR INTEGRATION

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The ideas expressed in this paper are those of the author and do not necessarily represent 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 September-October 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.

The Annex I Parties or countries referred to in this document are those listed in Annex I of the UNFCCC (as amended at the 3rd Conference of the Parties in December 1997): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Korea and Mexico, as OECD member countries, also participate in the Annex I Expert Group. Where this document refers to "countries" or "governments", it is also intended to include "regional economic organisations", if appropriate.

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Executive Summary

This paper offers a preliminary analysis of several scenarios for integration of sectoral approaches in international and national climate policy. We consider four broad types of sectoral approaches:

- A global action, i.e. a unilateral move by industry to foster GHG improvements.
- A global agreement between industry and Parties to the UNFCCC.
- A series of national policies targeting a sector, with some intergovernmental coordination.
- A sectoral crediting mechanism whereby reductions recorded at a sector level may be eligible for emission credits.

As a working assumption, all these approaches would seek to have direct, measurable impact on a sector's GHG emissions – other forms of international sector-based collaboration include technology agreements on research and development, and international information sharing efforts. We consider how each of these options would integrate in the existing climate regime, from the viewpoint of their effects on:

- Country-wide commitments.
- Kyoto Protocol mechanisms (including the treatment of international transactions).
- Domestic policy.

It is difficult at this stage to define global sectoral approaches with any precision. In particular, we make no judgment about their environmental effectiveness. The analysis remains therefore exploratory. Some options described here may appear politically unrealistic: it is not clear, for instance, that governments would take a hands-off attitude towards a global action that involves important economic sectors. Other options may face technical implementation barriers, or prove difficult to negotiate internationally. The paper does not seek to provide definitive answers. Rather it highlights only some of the issues arising from four broad options. Our preliminary analysis brings the following questions:

- Would sectoral approaches allow geographical flexibility (emissions trading) and how would this interact with country commitments? If such flexibility were allowed, would it require new mechanisms in the future climate change regime? Could the CDM be used for non-Annex I/Annex I transactions prompted by a sectoral agreement?
- Could governments "carve out" certain sectors from future commitments, if emissions from these sectors were covered by an international sectoral agreement? The carve-out model implies that governments treat the emissions of these sectors as well as their international GHG transactions separately from their GHG commitment and registry. This would be a radical change from the current approach of country-wide commitments in developed countries.
- Could a series of sectoral agreements with participation by some developing countries become the primary contribution of these countries to GHG mitigation? Could they substitute country-wide commitments for these countries?

The paper also touches on two unresolved issues. The first is the legal nature of an international sector-based approach, which would be partly defined by the legal status of its parties (countries or private companies) and their relevant jurisdictions. The second, more fundamental issue is the incentive for the participation of developing countries' industry, when it is engaged in international competition.

1. Introduction

The initial exchange of views about the future of the Kyoto Protocol and the Dialogue held in Bonn in May 2006 has shown interest in a sectoral, rather than purely national, look at greenhouse gas (GHG) mitigation. The following reasons, among others, trigger such interest:

- Industrialised countries that have introduced binding emission objectives are faced with a competitiveness risk that could also lead to so-called carbon leakage. A constraint on the emissions from the production of an internationally-traded good creates a cost not faced by competitors without such constraint. In time, this can lead to relocation and the displacement of emission sources (leakage), undermining the effectiveness of the environmental policy. A sector-wide approach could help manage competitiveness and leakage risks.

- In developing countries, rapidly growing activities with long-lived capital stocks may be locked in a carbon-intensive path in the future. This may generate large capital stocks with high GHG intensity; these would either need to be retired early at some economic cost to meet emission goals, or would slow down global efforts to reduce emissions if the costs are deemed too high. A sector-based approach could bring incentives for mitigation in these sectors developing countries without requiring economy-wide emission reductions[1].

In parallel, a number of Parties are in favour of enhancing the effectiveness of the Clean Development Mechanism. Several papers have already considered the possibility to extend the scope of the CDM from projects to whole sectors (Bosi and Ellis, 2005, Ellis and Baron, 2005, Baron and Ellis, 2006). These papers highlight the following issues:

- Baseline setting could prove difficult if countries lack reliable emissions data and projections at sector level.

- Potentially resource-intensive domestic implementation is needed to ensure effective participation in sectoral crediting, including monitoring and enforcement issues.

- The potentially large quantity of credits that would be generated – and need to be matched by demand from Annex I Parties.

- The potential aggravation of competitiveness concerns triggered by a sector-wide crediting mechanism that may reward "laggards" – a more prominent issue for traded products than for more domestic activities.

These issues notwithstanding, some projects open up the possibility for the CDM to move in the direction of policy-based crediting, through the inclusion of programmes of activities. As outlined in Ellis (2006), the methodology for the Ghana project that started the debate on programme of activities was resubmitted (and reviewed at the 21st meeting of the CDM's Methodology Panel). Subsequent to that, the CDM Executive Board opened a call for public comments on the issue, and has also asked both the Methodology Panel and the UNFCCC Secretariat to provide it with further guidance. It is too early to conclude on an evolution of the practice of the CDM in this domain. Yet this may indicate a possible evolution of the CDM from a project- to a sector-basis – or, at least, towards more encompassing "projects". A more progressive evolution may help assuage the concerns raised by sector-wide crediting (Baron and Ellis, 2006): rules would evolve as new, challenging methodologies, are being approved. Such learning-by-doing

[1] South Africa expressed the need for further "positive incentives" to trigger emission reductions in developing countries (UNFCCC, 2006).

could also suit developing countries that may not yet be equipped to handle a system covering a large number of sources within a sector.

Efforts to reduce emissions on a broad sectoral basis could take other forms than a crediting mechanism, however. This paper provides a scope of issues related to the integration of various sector-based approaches in the international climate policy regime.

2. Various Options for Sectoral Approaches

Sectoral approaches could take various forms – some of which already exist. At least four dimensions can define a sectoral approach:

- Geographical scope – is the approach global, international, national?

- Participants in the approach: UNFCCC Parties, individual governments, private sector entities (including industry associations).
  The nature of the commitment – a GHG emission objective, the diffusion of a given technology, an agreement to share information or pool R&D research, etc.

- The possibility to participate in international carbon markets. Sectoral crediting mechanisms could fit in that category. Other types of commitments (diffusion of a technology, agreement on pooling research and development resources) may not be amenable to transactions on the carbon market.

In what follows, we propose four rather broad options of sectoral approaches that could deliver greenhouse gas emission reductions. Each option is considered in section 3 from the viewpoint of its possible interactions with other, existing GHG mitigation frameworks, at domestic and international level.

The first three options (a global, industry-led, action; a global agreement between industry and governments; or an intergovernmental agreement then implemented at national level by respective governments) are only broadly defined – they could indeed take multiple forms. A sector could agree to meet a specific benchmark, defined as a technology, or as an energy efficiency goal, or a GHG intensity target. It could also agree to shift to a best available technology or low-CO_2 technology from a date onwards[2], with different timeframes for different groups of countries. While we presume that all these forms of commitments would lead to GHG emission reductions, these may not be quantified precisely, other than at some aggregate level. These goals could also span longer – or different – time periods than the commitment period agreed by Parties under the Kyoto Protocol. Design choices will have some bearing on whether and how these voluntary approaches can be integrated into the Kyoto Protocol's policy framework. We return to this question in section 3. The fourth option is a sectoral crediting mechanism.

2.1 Global action (GAn)

A global action (hereafter GAn) would be an industry-led pledge-and-review mechanism that would not be subject to government oversight.

Under a GAn, sectors could adopt greenhouse gas (GHG) goals, or agree on principles to move towards lower GHG emissions. For instance, a sector could propose to achieve a certain benchmark level for its activities by a given date, and possibly seek recognition from national governments (Parties) for such

[2] Edmonds and Wise (1999) proposed such an approach for CO_2 capture and storage.

effort. Or its participating companies may agree to set individual GHG emission objectives, either fixed or intensity-based, by a given date. GAn would offer a coordination forum for companies' mitigation efforts.

Depending on the diversity of the sector, this global sector-based action could consist of a number of benchmarks: the iron and steel sector could distinguish between the integrated steel plants and arc furnaces (the latter have notably different energy and CO2 requirements). The automobile industry could distinguish between personal vehicle, light-duty, trucks, or between fuels (gasoline versus diesel). Such design choices are not neutral when it comes to the agreement's environmental performance, an issue that is beyond the scope of this analysis however.

The GAn would need to set precise boundaries for both its products/outputs and related GHG emissions, so as to be able to credibly report on its achievements.

The industry could report its achievements on a regional or global scale. It may rely on its own means to ensure that the set benchmark is actually met. Alternatively, it could report on a country-by-country basis and rely on domestic policy frameworks to ensure monitoring, verification and review of GHG. While monitoring alone cannot guarantee that objectives are met, it would be an essential tool of communication between the private sector and governments, all the more so as countries are likely to demand increasing reductions from all sources and industry has a strong interest to demonstrate good practice.[3]

Examples of such initiatives already exist, although they are not global in their coverage. The International Aluminium Institute (IAI) has developed a range of voluntary objectives, some of which pertain to climate change mitigation (IAI, 2006):

- An 80% reduction in perfluorocarbon (PFC) greenhouse gas emissions for the Industry as a whole per tonne of aluminium produced by 2010 versus 1990.

- A 10% reduction in smelting energy usage for the Industry as a whole per tonne of aluminium produced by 2010 versus 1990.

- The industry will monitors aluminium used in transport, to track aluminium's contribution, through light-weighting, to a reduction in greenhouse gas (GHG).

- A reduction of GHG emissions from the production of alumina per tonne of alumina produced.

The Cement Sustainability Initiative of the World Business Council on Sustainable Development is another example. Individual companies taking part in the initiative have agreed to (WBCSD, 2002):

- Use a CO_2 protocol to define and make public their baseline, and report CO_2 emissions.

- Develop a climate change mitigation strategy, and publish targets and progress by 2006.

As such, these initiatives are not subject to government oversight. In the terminology employed here, such actions qualify as voluntary actions – as opposed to voluntary agreements, which assume some negotiation between a national authority and private entities.

[3] Whether governments would accept such action as sufficient in light of the global emission goals and efforts demanded in other activities is of course another question.

2.2 Global agreement with specific GHG goals (GAt)

Moving towards firmer commitments, an industry could meet internationally and negotiate a Global Agreement (hereafter GAt) with Parties to achieve certain greenhouse gas objectives. These could be expressed as emissions per unit of output, total emissions, the diffusion of certain low-GHG emitting technologies, etc.

The main difference with the preceding approach would be that the Global Agreement would involve Parties' endorsement of efforts in industry. For Parties where GHG policy is in place in these sectors, this could involve substituting the Agreement goals to domestic policy; for other Parties, the GAt would be a way to engage their industry towards lower emissions. Parties may also develop some enforcement mechanism to ensure that each party works towards the agreed outcome. For instance, it may be important for companies that each government put appropriate emissions (and other) monitoring mechanisms in place, so as to avoid certain companies free-riding on the agreement.

Presumably, industry would be interested in this approach as an alternative to, say, a more dispersed set of policies implemented at domestic level, or policies perceived to have a more negative impact on the sector as a whole – the threat of harsher policy instruments has been a traditional motivation of voluntary agreements.[4]

2.3 National policies with intergovernmental coordination (NPIC)

Moving from the global to the regional or national dimension, a sector could negotiate an agreement on GHG mitigation objectives with its government, based on some international coordination to handle competitiveness problems (we refer to this option as a set of national policies with intergovernmental coordination, or NPIC).

Examples of domestic sectoral agreements are numerous, although examples of international coordination are rare. Kulovesi and Keinänen (2006), in their study of legal aspects of a sector-based approach cite the agreement concluded between the European Commission and the European, Japanese and Korean car manufacturers associations on the specific target for CO_2 emissions per kilometre of new cars sold in Europe by 2008-2010. While the EC agreement has an international reach mostly: its implementation does not rely on a country-by-country plan. Another agreement that is noteworthy in the same sector is the Canadian automobile industry commitment to a 5.3 $MtCO_2$ reduction in emissions by 2010. Other examples include the covenants concluded between industry and government in the Netherlands during the 1990s, and the voluntary action plan put forward by the Japanese employers' association, Keidanren.[5]

In what follows, we assume that the national policies, be they based on voluntary agreements, would be legally-binding, recognising that not all such agreements share this characteristic at present.

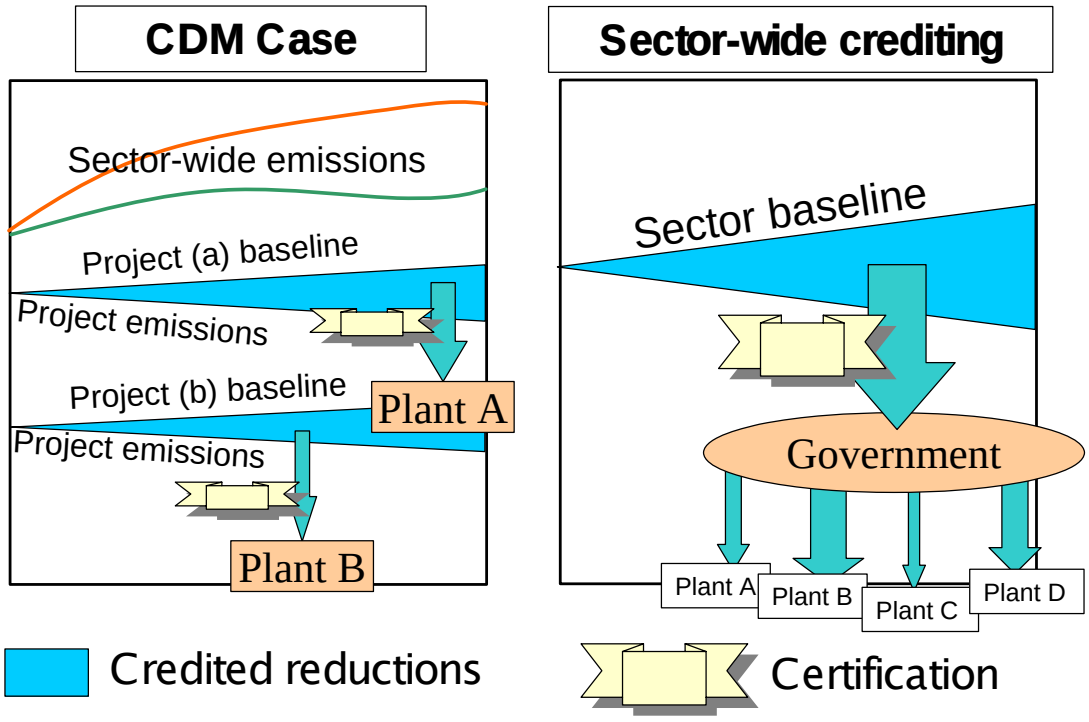
[4] Other ongoing initiatives that could lead to global voluntary actions or agreements include information sharing initiatives such as the sectoral task forces of the Charter for the Asia-Pacific Partnership on Clean Development and Climate, or the G8 Gleneagles Plan of Action. The latter mandates the IEA to gather information on best policy practice and to study areas for energy efficiency improvements in industrial activities. While such an evolution has not been envisioned by the G8, if promising, results could prompt industry to move together internationally and propose credible mitigation goals to UNFCCC Parties.

[5] www.keidanren.or.jp

2.4 Sectoral crediting mechanism (SCM)

Under this policy approach, developing countries would be allowed to volunteer whole sectors for GHG crediting, a step up from the current project-by-project approach of the CDM (see Ellis and Baron 2005, Baron and Ellis 2006). This approach, referred to as sectoral crediting mechanisms (SCM), would require setting a sector-wide baseline for each sector involved, developing a national mechanism to engage all players in the industry concerned, and a process to manage GHG crediting once credits have been granted at the country level. While holding the promise of generating more credits, such process would be more burdensome for domestic governments than existing arrangements under the CDM (Figure 1).

Figure 1: Sectoral crediting versus the Clean Development Mechanism



Studies mentioned above have explored three options for an SCM: a policy-based approach, a baseline set as an intensity target (tCO_2 per unit of output), or a system based on absolute emission caps. While not impossible, the last option seems less politically attractive to developing countries.[6] The CCAP "no lose" target resembles the intensity-based SCM (Schmidt and Helme, 2005).

A sectoral crediting mechanism presupposes an international demand for such credits, without which entities in eligible countries would have no incentive to reduce emissions below the baseline level. The demand for credits would presumably come from other countries' emission commitments, as in the case of countries in Annex B of the Kyoto Protocol. Other options for integration of SCM can also be explored.

A key distinction between the SCM and the other three options is that it assumes the possibility to trade emission reduction credits, and that only installations in developing countries would be eligible for crediting.

[6] Baron and Ellis (2006) stressed the competitiveness concerns that a broad-based SCM could generate, as new installations could benefit from GHG credits if they were to locate in eligible countries – non-Annex I, presumably.

Table 1: A typology of sectoral approaches

Global **A**ctio**n** (**GAn)**	A sector declares the intention to contribute to greenhouse gas mitigation efforts, ranging from an agreement on a set of principles (information sharing, R&D cooperation) to targets for emissions (fixed or intensity-based), on some international or global scale. The Action would be formulated unilaterally by industry. Examples: the WBCSD Cement Sustainability Initiative, the aluminium industry's IAI voluntary objectives.
Global **A**greemen**t** (**GAt**)	A sector elaborates and negotiates with governments a plan to limit its GHG emissions. Compared with a GAn, governments, possibly via the UNFCCC Parties, would be signatories to the Agreement, making it legally-binding.
National **P**olicies with some **I**ntergovernmental **C**oordination (**NPIC**)	Governments would negotiate an approach to GHG mitigation for a sector and agree to implement measures domestically.
Sectoral **C**rediting **M**echanisms (**SCM**)	Eligible Parties (presumably non-Annex I) volunteer whole sectors for GHG crediting, as an extension from the current project-by-project Clean Development Mechanism. While the above three options could span developed and developing countries sectors, crediting reductions under SCM is restricted to developing countries.

3. Integrating Sectoral Approaches in GHG Mitigation Regimes

The previous section offered 4 broad templates for sectoral approaches to greenhouse gas emission reductions, from a global industry-led action to sectoral crediting mechanisms. This section outlines how each approach would be integrated into, and interact with, existing climate policy frameworks. There is probably no single right scenario about the integration. It is also not possible to accurately predict what other climate policy developments may occur that could accommodate/run against these sectoral approaches. What follows should be taken as possible developments based on what remains limited information about the hypothetical development of sectoral approaches.

We review the above templates along the following dimensions:

- Country commitments: how does the sectoral approach interact with a country's GHG mitigation goal? How is the contribution to the country's commitment reflected? What about countries that have not taken emission reductions commitments and host activities in a sector that is now committed to certain goals?

- Kyoto Protocol mechanisms: does the sectoral approach interfere with the existing Kyoto Protocol mechanisms? For instance, SCM, whether national or international, could become a fourth flexibility mechanism – or the CDM could evolve into a sector-based crediting system.

- Domestic policy, ranging from command-and-control to various fiscal measures – taxes, subsidies – and domestic emissions trading systems.

In this discussion, we refer occasionally to a terminology borrowed from Baumert (2006) to describe models of sectoral cooperation:

- **Sector-only model**: this assumes no comprehensive country-wide agreement, but an effort to mitigate climate change that is the sum of various sectoral efforts that may be linked.

- **Complementary model**: an agreement such as the Kyoto Protocol can be complemented by a voluntary agreement, e.g. on motor vehicles.

- **Carve-out model**: e.g. under the Kyoto Protocol, international aviation and marine bunkers are not covered by countries' commitments – even if they are reported in their GHG inventories – and could be subject to a specific commitment.

- **Integrated model**: one example is the treatment of land-use change and forestry in the Kyoto Protocol; another would be a sectoral crediting mechanism to assist Parties to meet their emission commitments.

3.1 Sectoral approaches and country commitments

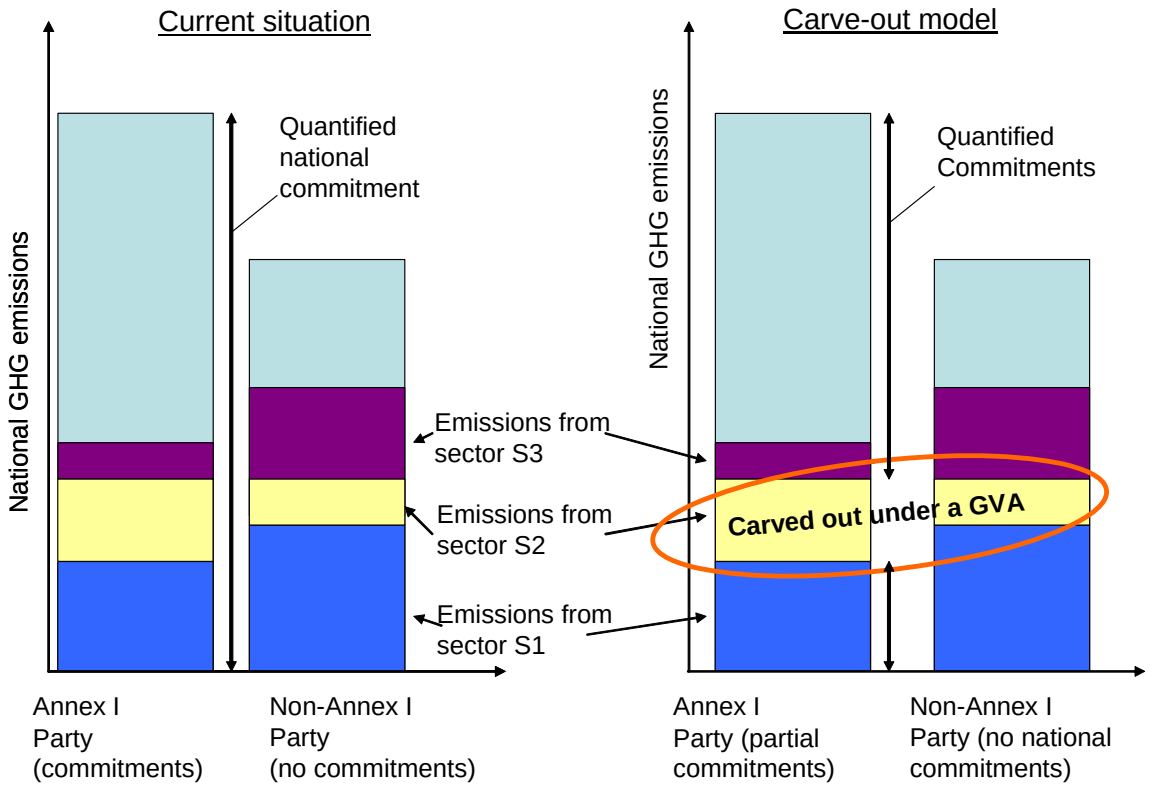
A global action (**GAn**) would seek to lower greenhouse gas emissions from a sector on a global basis, without any enforcement mechanism at national or international level. If successful, this approach could contribute to lowering emissions in various countries, some of which may have quantified national emission commitments. However, in the absence of a country-by-country devolution of the GAn objective and of an enforcement mechanism, it will be difficult for the country to count on firm emission reductions stemming from the GAn. GAn appears to fit Baumert's complementary model.

In parallel, countries without commitments would not feel bound by the existence of a GAn, as it would not require individual governments' commitment to enforce it on their territories.

A global agreement (**GAt**) could go farther, as the agreement presupposes some recognition – or avoidance of use of a "stick" – by governments, and some firm commitment by the industry. With a firmer GHG mitigation objective, an industry could decide to promote the agreement in two different directions:

- A carve-out approach (Figure 2): the industry becomes responsible for emissions within the boundaries defined by the GAt. For example, the aluminium industry could commit to an emissions objective covering its direct emissions (PFCs and CO_2). All countries harbouring aluminium smelters would report these emissions separately from their national emissions inventory. Countries' commitments would need to be negotiated in such light, e.g., knowing that an industry with a high potential for improvements and GHG reductions would no longer deliver its reductions to the benefit of the country's own commitment. Note that although carved-out, a sector may still not be treated equally from a climate policy perspective across countries, e.g., if power costs were much higher as a result of a climate policy measure taken in one but not all regions.

Figure 2: Country GHG inventories with sectoral approaches



- A complementary model: each country with installations belonging to the GAt could count on GHG improvements that it brings. The agreement, if environmentally ambitious, would generally contribute positively to countries' commitments. However, a government may have considered more ambitious objectives for the industry. These would be undermined by the global agreement, if it took precedence over domestic policy. Put differently, while a GAt may help move an industry on a path of low emissions globally, it may not result in an improvement of all countries' compliance position.

National policies based on some intergovernmental coordination (**NPIC**) would imply some target setting at national level, a clear indication of the sector's contribution to the country's total emissions. We note that such policies could also occur in countries without emission commitments, yet would be reported in their national communications – hence be recognised by other Parties, although without binding consequences at international level if compliance were not achieved. One could envision a series of such national policies adopted by developing countries as they develop the capacity to include various activities in a global mitigation effort. For some time, these countries could follow a sector-only model. A series of national voluntary agreements could be a vehicle for this.

In a similar fashion, a sectoral crediting mechanism (**SCM**) could create an incentive for countries and industries to implement domestic policies to generate credits – i.e. carbon revenues – on a sector level. If attractive and practical, SCM could develop across a range of activities and form the backbone of a country's national commitment – in this case, a non-binding target (Philibert and Pershing, 2001). In the long run, the downside of this strategy is to somewhat reinforce a divide between buying countries (countries with caps) and selling countries (with non-binding targets).

3.2 Sectoral approaches and Kyoto Protocol mechanisms

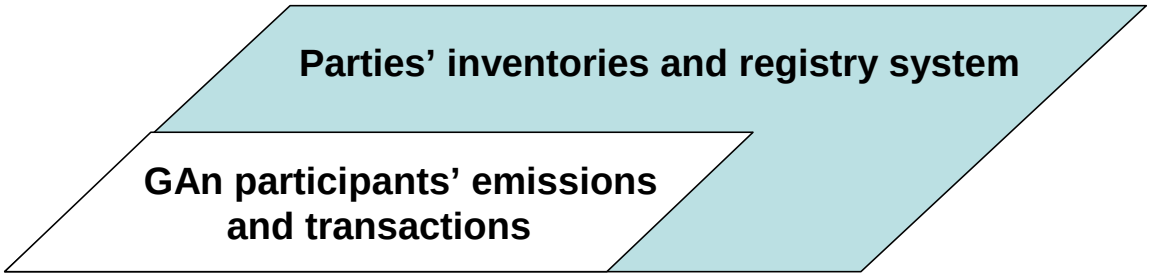
3.2.1 Global action

If based on a global benchmark, a global action (**GAn**) could influence the Kyoto Protocol mechanisms via the Clean Development Mechanism, if the benchmark were deemed to be an improvement from the sector's usual baseline.[7] If we assume that the goal is to reach, or improve from a given benchmark over a period of years, projects moving early to adopt the benchmark could be rewarded for such actions. Later projects may receive fewer credits. Similar developments could be expected under Joint Implementation (JI): a government hosting a JI project may adopt the GAn benchmark as a standard fit for crediting.

The impact of a global benchmark on CDM would not be automatic, however. Beyond the needed recognition that the benchmark represents an additional contribution to GHG reductions, it would then need to be translated into acceptable methodologies.[8]

Participants in a GAn, if their agreement were to define a precise CO_2 emissions goal, could also decide to trade emission reductions to achieve their goal cost-effectively. Figure 3 offers a schematic illustration of an integrated model: inventories and transactions of GAn participants are part and parcel of the inventory and registry system of Parties.

Figure 3: Parties record transactions under a global action



For governments to allow international GHG transactions (whether under JI, CDM, or emissions trading), they would need to translate a global action into a set of domestic goals for the industry – and then allow international transactions in assigned amount units to occur on that basis, in the case of Kyoto Parties. Further, the GAn goal could be intensity-based (tCO_2-eq per unit of output) while the countries' objectives could be fixed caps. If trading related to the GAn were to be accounted for in countries' registries, how would assigned amount units be allocated to these entities, knowing that they do not face fixed caps? While not impossible, such transactions would require careful thinking by governments.

Since entities operating in non-Annex I may be participants in the GAn, credit transactions from developing countries to developed countries could only occur via the CDM – or another, yet to be agreed

[7] The CDM allows for such approach as described in para 48a, 17/CP.7 with a reference to "existing or historical" emissions. Several methods use this approach, which often translates into a plant-specific (not sector-specific) baseline. Thus, CDM projects can get credits if they improve plant performance. Whether the improvement is established from a sector benchmark is often not assessed – although it has been e.g. for some of the aluminium methodologies (NM0124, NM0162).

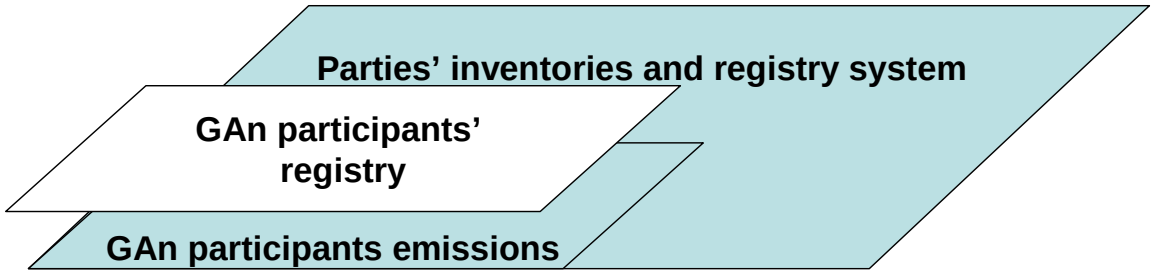
[8] Recall also that a GAn can be a commitment that is hard to translate into precise GHG reductions (e.g. information sharing, R&D pooling, etc.) in which case it would not have a bearing on the CDM.

mechanism. Let us follow the CDM path: presumably, the Executive Board could register and process these transactions like other CDM projects. This would require developing appropriate methodologies for the sector at stake – some projects to reduce PFC emissions in the aluminium industry, in the frame of the industry's action, are indeed claiming credits under the CDM.[9]

For the sake of completeness, let us now turn to the opposite assumption on governments' treatment of a GAn: governments do not wish to keep track of international transactions. Governments could be interested in assuring that the global action delivers promised reductions, but not so much in how the burden is shared among players – i.e., who bought or sold in order to meet compliance would not concern governments.[10]

The GAn emissions would not be carved out, however, as there is no formal agreement between industry and Parties. Parties would still include the GAn participants' emissions in their inventories (see Figure 4). However, whether their sources bought or sold allowances from sources located in other Parties would not be registered by the Parties' registries, except if they proceeded under the CDM, JI, or emissions trading.

Figure 4: Transactions under a global action are not tracked by Parties' registries



Let us also assume that compliance with the GAn goal is measured on the global scale only. For instance, participants report that the global emissions associated with product A amount to x tonnes of CO_2-eq per unit of output, in accordance with the GAn's objective. Both emissions and product volumes are monitored and certified in a way that suits all parties involved. On this basis, the geographical distribution of efforts, and which entities traded what quantities of emission reductions to get there, may be considered irrelevant by governments – unless, some perceive that the GAn distorts competition against their industry. In addition, the industry may choose to adopt different time frames for commitments than those agreed among Parties, which would make tracking transactions and compliance even more arduous.

Should governments incorporate GHG transactions into their registries? One downside of not accounting for international GHG transactions underlying a GAn relates to the distribution of cost for compliance at domestic level. Let us assume a GAn participant with emissions above target – adding to the country's inventory. It may have acquired emission reductions from other participants to be in compliance, yet these would not be accounted for in the country's registry. The government would need to introduce other GHG mitigation measures or acquire AAUs from other Parties in order to offset such increase. The country, as a whole, would have incurred twice the cost necessary to offset these emissions, since both the GAn

[9] See http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=14&OpenNM=NM0162&cases=B#NM0162

[10] Regardless of the treatment of transactions from a climate policy perspective, the fact that transactions in emission allowances do occur would force governments to give a fiscal status to such allowances. Transactions would therefore be visible to governments, but they need not interfere with transactions, other than for fiscal reasons.

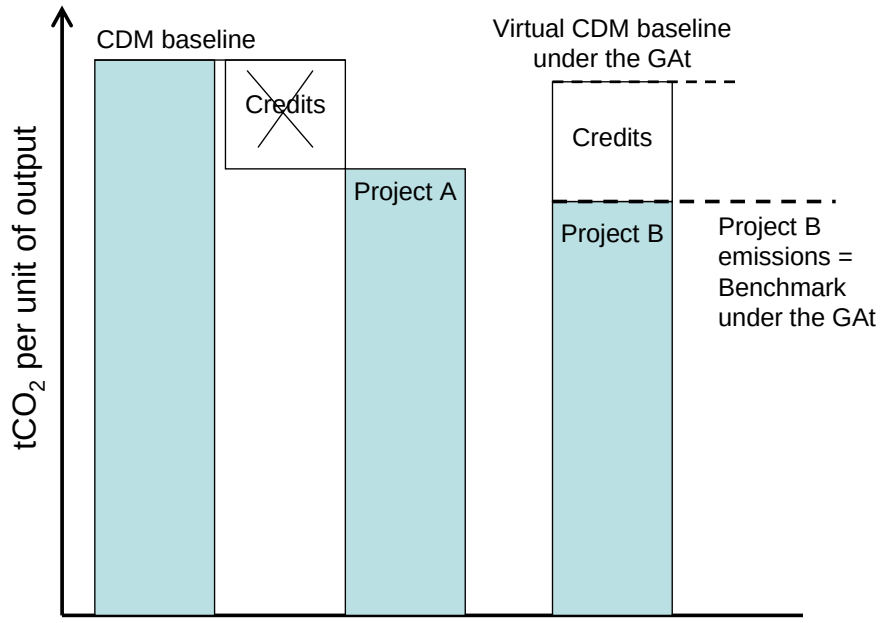
participant and the government would have offset the rise in emissions. This somewhat absurd outcome forces us to reconsider the possibility that a government would choose to ignore international transactions taking place under a GAn. If it decides to allow transactions, its involvement in the GAn must be much more prominent that assumed initially – a GAn assumes that Parties do not negotiate with industry; the effort is led by industry alone, as a pledge-and-review process. While this is not definite evidence, we note that neither the IAI initiative nor the Cement Sustainability Initiative include international transactions among their participants – while they may well trade under other existing Kyoto Protocol or domestic/regional mechanisms.

3.2.2 Global agreement

Under certain conditions, a global agreement (**GAt**), i.e. a stricter approach than the GAn, could influence the CDM more directly. If it were to set a single global intensity goal, under certain assumptions it could avoid crediting where the "additional" technology is not as efficient as a benchmark technology used in developed countries – situations which imply that CDM credits could encourage relocation to developing countries. Here, a single benchmark technology could be encouraged, regardless of the country.

Figure 5 proposes one illustration of how a GAt could be used to foster more rapid technology move towards a global benchmark, through the CDM. The new CDM project A – which does not meet the agreed benchmark – could simply no longer be eligible. Only projects that emit at or below the agreed benchmark would receive credits, such as project B. A "virtual" CDM baseline could be chosen above the GAt benchmark to facilitate the crediting procedure for such projects.

Figure 5: CDM credits under a global agreement with a benchmark

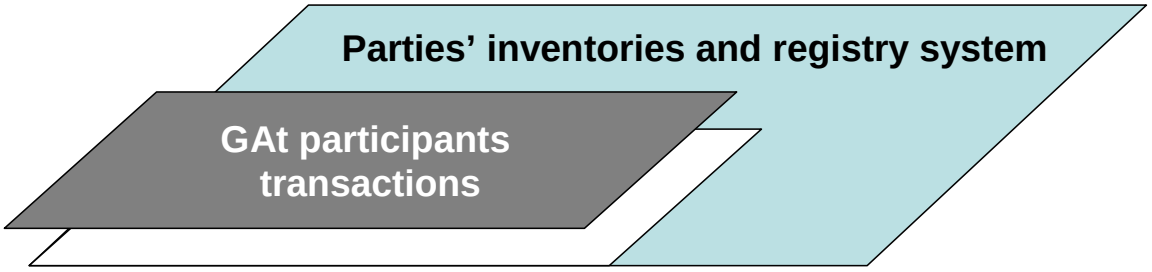


Parties would need to state whether CDM projects baselines should take into account the goals set by the agreement. The negotiation over the GAt could include the treatment of the sector inside the CDM, for instance. Baron and Ellis (2006) noted that arriving at a global baseline would be arduous, at least from a technical viewpoint – national circumstances differ, including fuel mixes; production and products are not homogenous, comprehensive data bases are not always available...

If a GAt were of a "carve-out" nature – i.e. implying "exclusion" of the sector's emissions from national commitments, as illustrated in Figure 6 – it could require setting another emissions trading vehicle, provided that participants wish to exploit such flexibility. One reason for this is that entities operating in capped countries ought to be able to trade without having their transactions impact on the country's compliance situation. Technically, registries could probably handle two types of entities – those covered by the country's commitment and those that are not.[11]

There also may be a decision not to allow entities under the GAt to sell into the Kyoto system, e.g. if the GAt were based on intensity targets and Parties wished to retain a trading system based on fixed targets. Some gateway mechanism could be envisioned for that purpose, however: GAt entities would be allowed to sell into Parties' registry system provided that they have kept the sector's total emissions under a pre-agreed level, for instance. There may of course be cases where GAt entities need to buy from Parties' registry system in order to comply with their goals under the agreement.

Figure 6: Global agreement carved out of Parties' commitments



3.2.3 Sectoral crediting mechanism

SCM could either evolve from the CDM or be "implanted" into the Kyoto Protocol framework as another flexibility mechanism. Earlier work (Baron and Ellis, 2006) has considered the interaction and possible overlap with the CDM, with respect to baseline setting, in particular. The choice of one instrument versus the other would largely be a function of the host country's ability to manage the complexity of SCM – sector-wide data gathering, monitoring, creating effective incentives at domestic level, distribution of credits among all sources on a fair basis, etc.

One issue raised about SCM relates to the magnitude of credits that it could generate – and the fact that such credits would merely offset emissions in countries with emissions commitments. If the potentially large supply of SCM credits were a concern for these countries, Parties could choose to treat SCM differently from other existing Kyoto mechanisms. In the latter, "a tonne is a tonne": a certified emission reduction (CER) can be used to offset the emission of one tCO_2-eq in all Annex I countries; with the exception of temporary CERs, a CER is equivalent to an assigned amount unit, in compliance terms. In an attempt to solve the large supply of SCM credits, Parties could agree to discount them, i.e. by adopting a declining valuation schedule for credits (100% of emission reductions credited on year 1, 90% on year 2, etc.) Another, more straightforward, way to handle this problem is by adopting baselines that are below business-as-usual, such as non-binding targets (Philibert and Pershing, 2001) and the "no-lose" sectoral targets researched by CCAP (Schmidt and Helme, 2005).

[11] We already mentioned one downside of the carve-out model: it leaves a country with less flexibility to distribute the mitigation effort across various sectors and sources on its territory.

3.3 Sectoral approaches and domestic policy

The question of the interaction between sectoral approaches and domestic climate policy is fairly broad: there are numerous policies and measures in place to date that apply to activities that could partake in a sectoral approach. To what extent does the sectoral approach supersede such policies? Or is it complementary? Does the sector seek, through an international agreement, to be exempted from existing domestic policies? Does the sectoral approach affect the terms of domestic policy objectives? Is it then acceptable by governments?

A global action (**GAn**), as a unilateral initiative by industry, need not interfere with domestic policy – e.g. EU installations belonging to the members of the Cement Sustainability Initiative are still subject to a CO_2 emissions cap under the EU ETS. One can interpret such actions as complementary to what countries are already implementing in these sectors. It is of course not inconceivable that, based on successes under the GAn, governments recognise the approach as a valuable vehicle for future GHG mitigation in the industry and decides to officialise it through domestic implementation (e.g. by adopting the industry benchmark to establish future objectives in a domestic or regional cap-and-trade system).

A global agreement (**GAt**) or a set of national policies based on some intergovernmental coordination (**NPIC**) could include a clause whereby governments accept that the agreement replaces other domestic policies imposed on the industry to reduce its GHG emissions – whether these are support measures like subsidies or command-and-control, taxes, cap-and-trade or past voluntary agreements.[12] Essentially, companies under a GAt would only need to meet the requirements of their agreement within the boundaries defined in the agreement – a fully global reach may not be achievable in the near term. This would obviously imply that the goals set under the GAt are convincing enough for governments to give up their existing approach to GHG reductions in the sector. It may not be trivial for domestic legislatures to abandon past policies on the basis of an agreement concluded between Parties (e.g. in an intergovernmental forum like the UNFCCC) and private sector entities. This could make or break agreements between national governments and industry on a global scale.

As mentioned already, a sectoral crediting mechanism SCM could raise competitiveness concerns, if large quantities of credits are bought from developing country industries that modernise, while developed country competitors face compliance costs (Baron and Ellis, 2006). This phenomenon could limit the stringency of targets that governments wish to impose on their industries, as the mechanism would enhance their uncapped competitors' cost advantage – this concern is of less relevance when sectors are not engaged in international competition. Further, experience with the CDM shows that the emissions market can trigger large reductions in somewhat unexpected activities; sectoral crediting could very well bring similar surprises and force governments to adjust domestic policies if competitiveness concerns arose as a result.

4. Other Issues for Integration

The previous section sought to explore how various types of sectoral approaches would fit in the current climate regime, from the existing country commitments to the Kyoto mechanisms and domestic policy implementation. This section turns to two very different, yet important dimensions for the success of any sectoral approach. The first dimension is the legal nature of a global sectoral approach – SCM and NPIC

[12] Voluntary agreements are often negotiated as industry faces the threat of a less favourable regulation. The Japanese industry Keindanren voluntary action plan arguably fits in that category. So far, the Japanese government has not implemented mandatory measures to reduce GHG emissions in industry.

are not considered here. The second dimension is the nature of the incentives for developing countries. We offer preliminary views on both.

4.1 Legal aspects of sector-based approaches to climate mitigation

In their review of legal aspects of sector-based approaches, Kulovesi and Keinänen (2006) describe two categories of so-called procedural sectoral models:

- The incorporation of sector-based commitments into the existing climate regime of the UNFCCC and the Kyoto Protocol – Baumert's integrated or complementary models (2006). Parties would negotiate and agree to a set of sectoral objectives.[13] These agreements would be subject to public international law.

- "Agreements concluded by representative of industry sectors or between state(s) and industry sectors."

There are not, as far as we know, global environmental agreements in this second category – these exist at regional and national levels (voluntary agreements, such as the one between the European Commission and various regional car manufacturers). The authors add that industry federations are usually entities established under national legal systems.[14] Any agreement involving these entities would belong to the domain of municipal law (i.e. national) – unless participants in the agreement (Parties and private entities) choose international law as applicable law.

The implications of resorting to national law rather than international public law to provide the sectoral approach's legal basis are not clear, as the sector-based approaches are not defined yet, and no precedent exists. Kulovesi and Keinänen do stress that these negotiations would only engage parties to the agreement – private entities representing the sector and states if they so decide, e.g. if they wanted to be bound by a global voluntary agreement. For sectoral approaches bringing together only private entities, neither the UNFCCC nor non-governmental organisations would have formal rights to participate.

One alternative would be for governments to negotiate among themselves an approach for GHG mitigation in certain activities – with proper input from the sectoral stakeholders. Each government would then go ahead and implement the agreement on its own territory, a form of coordinated policy measure. The above-mentioned legal issues may be greatly simplified under this approach, *once* Parties have agreed to an international mechanism – including compliance, dispute settlement, etc. – and each Party has developed a domestic implementation regime, with its own set of compliance rules. Parties would be responsible internationally, under international public law, and private entities would be responsible under the jurisdiction of their country of operation. This form of negotiation would resemble the World Trade Organisation process. A prerequisite for such development would be that Parties, including those currently without constraint on their emissions, agree to tackle emissions of some of these sectors. Without concluding on legal aspects of sectoral approaches, we now turn to incentives for participation.

[13] The authors add that "[it] would call for important modifications to the structure and design of the Kyoto Protocol but nothing in international law prevents states from doing so provided that they are able to agree on such alterations." *Ibid.*

[14] As an illustration, the ICAO and IMO are intergovernmental organizations, whereas the International Aluminium Institute is a legal entity established under the British Legal System (Kulovesi, Keinänen, 2006).

4.2 Incentives for participation by developing countries

The question of incentives for participation by developing countries in GHG mitigation is critical in the success of any approach to combat climate change. Carbon finance and associated revenues, contribution to sustainable development and technology assistance/transfer are the broad incentives generally considered. To what extent sectoral approaches can draw on these is an open question. Following are some general views on how sectoral approaches could draw the interest of developing countries. Whether and how some of these elements would play out in sectoral approaches is beyond the scope of this paper.

Among the above four options, SCM, arguably the best defined, is the only option that brings with it a clear incentive for participation. It could create an important revenue stream for countries that put in place adequate domestic policies to generate carbon credits. Depending on how the system is implemented domestically, entities may be strong supporters of it as well. Earlier work has emphasised, however, the competitiveness concerns that such approach would raise as installations in developing countries would get paid – receive carbon credits – to modernise while installations in countries with caps could face a carbon cost (Baron and Ellis, 2006). In a worst-case scenario, SCM could promote relocation to developing countries, at no net gain to the environment.

In the GAn model – pledge-and-review, with no commitment by governments – the success of the negotiation among private sector participants would hinge on what each brings into the bargain. One positive element is that companies whose activities are located in industrialised and developing countries would cut across the standard division lines in international climate negotiations – Annex I versus non-Annex I. The onus would be on the industry as a whole to demonstrate global progress, and to share the burden among participating entities in developing and developed countries.[15]

The other two options (a global or a series of NPIC) would result from a negotiating process between Parties (including non-Annex I) and sectors. Developing countries that harbour sources in sectors under negotiation would indirectly benefit, by making such reductions their own. This may make their country-wide commitment of a lesser importance to the global community. A developing country could build up its contribution to GHG mitigation through the participation of its industries to international sectoral objectives. This would put these countries in the "sector-only" model presented by Baumert (2006).

Another form of benefit from participation by developing countries is that Parties, as a group, may carry more weight in a negotiation with industry than a single government. While some developing countries could gain from policies such as those targeting energy efficiency improvements, enhancing energy security through the promotion of more efficient vehicles, they are not always in a position to negotiate with industry to achieve such goals. An international negotiation between UNFCCC Parties and industry could help deliver progress on the domestic front, otherwise out of reach for some developing countries. As an illustration, the interest of G8 leaders in IEA's work on enhancing the efficiency in specific domains (set-top boxes, standby power, tyres and lighting) could, if it led to policy implementation by the G8 countries, trigger energy efficiency improvements world wide.[16]

[15] We have noted earlier (Ellis, Baron, 2005) that the most modern facilities are not necessarily found in developed countries, in the case of aluminium smelters, for instance. In such cases, the potential for modernisation may be more pronounced in developed countries.

[16] http://www.iea.org/G8/index.htm

5. Concluding Remarks and Areas for Further Research

This paper offered some exploration on various integration scenarios based on schematic options for sectoral approaches. Some of these scenarios may lack political realism – would a country easily let go of GHG policies in certain sectors against an international sector-level commitment? The interactions with existing mechanisms under the Kyoto Protocol may not be straightforward either. All these issues will only be resolved once industrial sectors with an interest in these approaches offer practical options as to how a sectoral approach or mechanism could function. This is not addressed here. There is indeed scant information to narrow the list of options for sectoral approaches. In particular, whether various countries and sectors would be equipped to properly assess the contribution of certain sectors to GHG emissions, draw projections, monitor and verify progress may be an important barrier to an effective participation by developing countries and their industry. Identifying information and institutional capacity needs should be a priority if governments are to consider a sector-based approach to GHG mitigation of near-global reach.

The paper does not dwell on the different implications of sectoral approaches for developing countries versus developed countries. As developed countries embark on a negotiation of post-2012 commitments, they could consider sectoral approaches in formulating such commitments. There is a permanent need for negotiators to assess which activities can deliver GHG reductions over what timeframe – and at what cost. Whether or not a sectoral approach can be effective to reduce GHG emissions in certain activities (i.e. be a "complement" to country commitments), a closer sector-level look should bring valuable information on what is practically achievable, and on the constraints/opportunities that exist in specific activities.

Most of the existing work to date on sectoral approaches has focused on heavy-industry activities that have a direct impact on GHG emissions. Options should also considered in the myriad of energy end-uses with a more diffuse yet compelling impact on emissions: more evidence is brought to the table on the very high cost-effectiveness of energy efficiency measures, and on the remaining potential to reduce CO_2 emissions at negative costs (IEA 2006a, 2006b, 2006c). There may be avenues to exploit this potential through some form of international collaboration. The private banking sector could also be engaged in this discussion; it is often less aware than energy policy specialists about the economic potential of energy efficiency investments (see, on the subject of financing energy efficiency: World Bank 2006).

Another important issue is that of incentives for the participation of developing countries in any form of international sectoral approach. Sectoral approaches could, once they have alleviated competition concerns, bring more efficient, cleaner technologies to industry participants on an international scale – an incentive for developing country participants. Some now argue in favour of using border tax adjustments until foreign competitors adopt measures of similar environmental ambition. While the feasibility (and WTO-compatibility) of tariffs based on carbon cost is not ascertained, such measures could be seen as a transitional measure (but also an incentive?) towards a more global reduction effort in a sector. On a brighter side, a sectoral look could lead to positive outcomes, e.g. through energy efficiency improvements. More ambitious energy efficiency policies have demonstrated economic, social, and of course environmental benefits that all Parties should recognise as valuable for their own sake, notwithstanding their contribution to lower GHG emissions (WRI, 2005). Parties may still lack fora in which they can address these more specific policy questions.

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