

Executive Summary

Introduction and scope

This paper explores sectoral approaches as a new set of options to enhance the effectiveness of greenhouse gas reduction policies and to engage emerging economies on a lower emission path. It surveys existing literature and recent policy trends in international climate change discussions, and provides an overview of sectoral approaches in specific of trade-exposed, greenhouse-gas intensive industries (cement, iron and steel and cement). It is also based on interviews conducted by the IEA Secretariat in Australia, China, Europe, Japan, and the United States. Sectoral approaches were also discussed during workshops on technology and energy efficiency policies in industry, following the IEA's mandate under the Gleneagles Plan of Action.

At their meeting in Heiligendamm, the G8 leaders summarised the challenges ahead for climate policy: they recognise *“that the efforts of developed economies will not be sufficient and that new approaches for contributions by other countries are needed [...] Action of emerging economies could take several forms, such as sustainable development policies and measures, an improved and strengthened clean development mechanism, the setting up of plans for the sectors that generate most pollution so as to reduce their greenhouse gas emissions compared with a business as usual scenario.”* Further, the communiqué stresses the need for *“policy frameworks that co-ordinate rather than compete with each other [...]”* As countries embark on a new round of climate policy negotiations, they need to consider the implications of various emission goals, starting from their knowledge of potentials for greenhouse gas reductions, and their cost.¹ In parallel, we observe also country pledges on energy efficiency and international collaboration on specific sectors, including industry.

With the implementation of binding emission targets in some parts of the world (e.g. under the EU emissions trading scheme), trade-exposed and emissions-intensive activities have flagged the competitive distortions coming from the lack of similar efforts taken elsewhere.² The existing dichotomy between Annex I and non-Annex I Parties under the UNFCCC only reinforces such concerns³.

We identified three broad interests underlying the possible development of sectoral approaches:

1. *To address competitiveness concerns.* To engage certain emitting activities on a more global basis in an attempt to alleviate these concerns, as well as to ensure the sustainability of sectors that are especially GHG-intensive.
2. *To start engaging countries in a global GHG reduction effort,* through sector-specific objectives and instruments.
3. *To build commitments from a bottom-up sectoral analysis.* The evaluation of mitigation potentials on a sectoral basis would be a starting point for setting future country-level greenhouse gas commitments.

Because of its emphasis on heavy industry, the present report touches primarily on the first two aspects, with some discussion of issues related to the third.

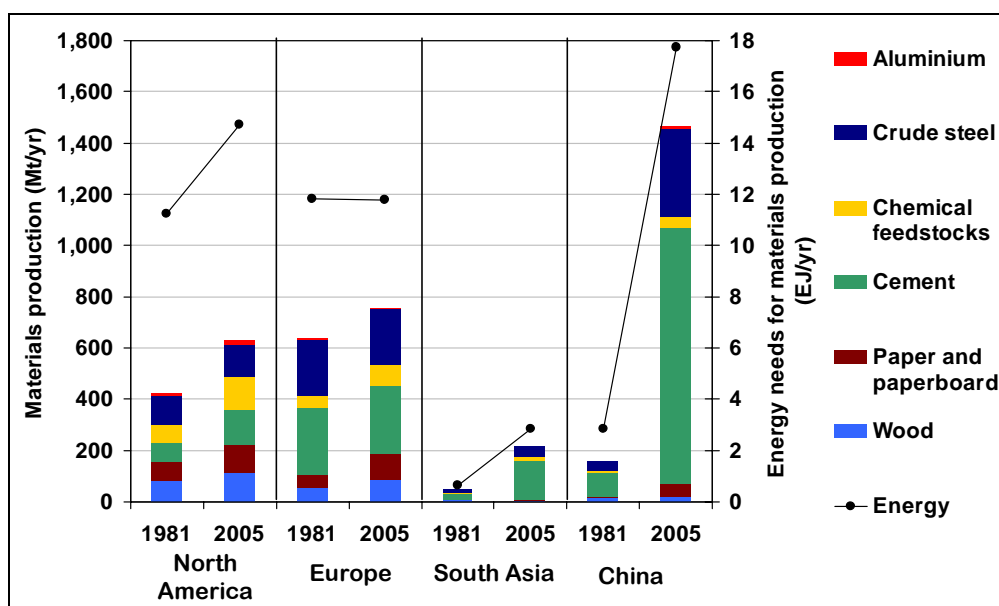
¹ The Intergovernmental Panel on Climate Change, in its survey of the literature on the mitigation of climate change, confirms that significant reductions in GHG emissions will require imposing a cost on emissions (IPCC, 2007). When, how and where such cost is implemented is of paramount importance for the effectiveness of mitigation efforts.

² In the conclusions of its May 2006 meeting, the *Ad hoc working group on further commitments for Annex I Parties under the Kyoto Protocol* (AWG) included *“Emission trends and mitigation potential of Annex I Parties (d) Sectoral analyses and impacts on competitiveness”* in its indicative list of topics for further work (UNFCCC, 2006).

³ The Russian delegation has tabled a proposal for voluntary commitments by developing countries. Yet to date, no developing country has come forward with a voluntary commitment to limit emissions.

The three sectors covered in this report (aluminium, cement, and iron and steel) currently account for more than 10% of global GHG emissions and are growing rapidly, under the impetus of China, but also India and other emerging economies (Figure 1).

Figure 1: Output growth and energy use of heavy industry (selected regions, 1981-2005)



Source: IEA, 2007c.

From the standpoint of climate policy-makers, sectoral approaches (SA) could be a vehicle to enhance the effectiveness, and broaden the scope of GHG mitigation efforts. Emission trends over the last decade clearly indicate that developing countries will soon surpass industrialised countries in terms of energy-related CO₂ emissions - in spite of still fairly low emissions on a per capita basis. These countries have legitimate development priorities, but they also face growing energy and environmental problems and have started taking measures with potentially positive effects on CO₂ emissions. This may indicate an avenue for a bottom-up international collaboration. The identification of best policy practice for energy efficiency, as mandated to the IEA by the G8 leaders in Gleneagles, may provide useful input to further discussions.

Sectoral approaches and competitiveness

Part of the discussion on SA has been prompted by competitiveness concerns arising from the introduction of CO₂ policy mitigation costs in some parts of the world and not in others - with the possibility of carbon leakage as a detrimental consequence: emissions reduced in one region would be partly offset by emissions increase elsewhere. This competitiveness concern applies mostly to energy and emissions-intensive, trade-exposed industries, i.e. activities that would support a high mitigation cost and can see their product's market challenged by foreign competitors as a result. Aluminium, cement and iron and steel fit in this category, although at various degrees. At the same time, if the reality of GHG mitigation costs cannot be denied - at least for some countries - international competition and investment choices in heavy industry are driven by many factors, of which energy cost is only one. Disentangling its particular role - and the role of climate policy therein - proves analytically difficult and so does the design of policies to deal with the possible effects on competitiveness.

One caveat against sectoral approaches is the risk to create “CO₂ havens” for the sectors involved, with marginal costs of reductions that could differ from that faced by other activities. Any significant difference in marginal cost would indeed lead to a higher total cost of GHG reductions. Another risk is that of “forum-shopping” - the possibility to bring the negotiation of goals where the less stringent objective is likely to be found. In the end, if SA are to solve concerns on competitiveness, they should meet the following three criteria:

- *Environmental effectiveness*: Do SA help to introduce meaningful GHG mitigation objectives?
- *Fairness*: Without pretending to set a perfectly level playing field, does the proposed approach address existing distortions due to uneven carbon constraints?
- *Cost-effectiveness*: Do SA run the risk of setting different carbon costs applied to different activities?

Defining sectoral approaches

While the term “sectoral approach” (SA) appeared recently in international climate policy debates, some international sectoral approaches have been in place for years, and already contributed to GHG reductions. Pledges on GHG emissions and performance have been initiated by industry, including under the aegis of the International Aluminium Institute (IAI), or the World Business Council on Sustainable Development’s Cement Sustainability Initiative (CSI), and are being developed further, with the hope to influence policy. The International Iron and Steel Institute issued a statement along these lines earlier this year - and has been coordinating a set of research and development programmes on low-CO₂ steel making (the CO₂ breakthrough programme). Other examples of sectoral approaches include the EU emissions trading scheme (EU ETS), although if it covers similar activities across now 27 countries, it does not prescribe -yet- a harmonised approach for each sector. Bringing together Australia, China, India, Japan, South Korea, the United States, and more recently Canada, the Asia-Pacific Partnership for Clean Development and Climate (APP), a non-binding public-private initiative seeking to help the diffusion of best practice to improve energy efficiency, energy security, local and global environment effects, across a range of activities is another example of a sectoral approach. These initiatives differ in their participants’ motivations, geographical scope, their legal nature, and the cost associated with emission reductions.

With the above-mentioned scope in mind, four broad categories of SA were identified:

1. **Country-specific quantitative approach**: A country’s initiative limited to a sector, recognised by the international community (e.g. UNFCCC Parties). Here, one could envision the possibility to credit greenhouse gas emission reductions on a sectoral basis, while the existing Clean Development Mechanism does so at project level only.
2. **Sustainable development policies and measures (SD-PAMs)**. A country would pledge a policy that delivers both sustainable development objectives and, incidentally, lower greenhouse gas emissions. This pledge would be made to the international community (e.g. the UNFCCC conference of the Parties).
3. **Transnational quantitative sectoral approach**. The most challenging of all options, these would aim at engaging a sector on a broad international basis.
4. **Technology-oriented approaches**. These range from pooled or coordinated R&D on innovative, low-GHG technologies, to activities towards the diffusion of existing technologies.

Case studies in industry

A sound approach to sectoral GHG emissions mitigation requires a thorough understanding of today’s situation on a sector-specific basis, as well as a vision of tomorrow’s challenges, beyond that of climate change constraints. Energy and input prices differ, local environmental constraints are not always

binding, and various local regulations and product preferences affect, positively or negatively, the local potential for CO₂ emission reductions. Growth in demand is an important driver of capacity development and of the diffusion of new, more efficient, technologies.

An essential result from case studies is that when it comes to energy/CO₂ performance, the frontier between developed and developing countries becomes blurred. While on average OECD countries' industry tends to use energy more efficiently, the most efficient plants are sometimes found in developing countries. If capacity and technology are available in these regions, the central question is how to promote their broader diffusion.

Production, market concentration and trade in aluminium, cement, iron and steel

	Aluminium (2004)		Cement (2005)	Steel (2005)
	Primary	Secondary		
Total production (Mt/year)	29.9	7.7	2,284	1,130
% traded	75%		6%	32%
Share of 10 largest firms	54%		< 25%	26.4%
Emissions				
Total emissions (MtCO ₂ eq.)	391		1,930	2,165
% total GHG emissions	0.9%		4.6%	5.2%

Source: IISI, 2006; Watson et al, 2005, Vieillefosse, 2006.

The above table provides basic statistics for aluminium, cement and iron and steel. The degree of market concentration may be a good indicator of a sector's ability to mobilise a critical mass to move the industry forward.

Our review of GHG mitigation policies and measures across a range of countries indicates strongly that so-called national circumstances loom large: governments in Annex I countries have taken very diverse policy measures to limit GHG emissions in the sectors covered here. In some cases, initiatives came from industry - be they voluntary actions at national level (Keidanren's voluntary action plan), or international, such as the CSI or the IAI efforts to reduce PFC emissions and energy intensity. There is little commonality in the approach of the EU emissions trading scheme and voluntary agreements established elsewhere. One implies a clear carbon cost signal - although burdens have been heterogeneous across installations - and higher electricity prices; the cost incurred by companies under voluntary agreements is less easily measured, and so is the effect of such measures on cost-competitiveness.

The very rapid output growth outside the OECD regions, in China especially, is clearly an overriding factor in industry discussion on SA. Such growth in capacity creates concerns about sectors' global contribution to GHG, but also on the evolution of international markets if Chinese demand were to slow down and trigger significant over-capacity. Such a situation, if it occurred, would be independent from climate change policy however. Interestingly, China has started removing some of the preferential energy price and export treatments for energy-intensive industry, as it considers the negative effects on domestic resources, including the environment.

Of all three materials, cement is the least traded. It is not clear, therefore, that a sectoral approach in this sector should focus on defining a level playing field - where several playing fields exist. Aluminium appears to be an exception, with a rather homogenous, widely traded product. Location choices for new smelters are more driven by the availability of cheap inputs than by local demand - with China being an exception. Experience to date shows genuine and effective efforts to reduce the emission of

PFCs - very potent GHG. The challenge for this sector lays more in emissions associated with electricity, especially in coal-based China.

As it stands, APP provides a means to diffuse best practice, and could help gather data that has been lacking on energy and environment performance in key industrial activities, mainly in China and India. For now, APP industry partners intend to collaborate on a commercial basis; the steel task force, however, has provided a first estimate a potential for CO₂ reductions based on currently used technologies. Whether APP will succeed in bringing significant improvements in energy efficiency and environment depends on a range of factors, starting with China and India's domestic policy objectives and prevailing energy prices, and potential assistance provided by Partner countries.

Both CSI and IISI have provided their vision of climate policy for their sectors, each relying on some form of GHG baseline-and-crediting approach. In European discussions, differences emerge, however: while the cement sector proposes country-specific goals, the European steel industry offers an approach that would reward higher than average performance and penalise installations below, based on a global assessment.

Turning to technology development, iron and steel seems the most advanced in efforts to develop low-CO₂ steelmaking processes, with coordination ensured by the IISI. The cement industry has also started investigating breakthrough technologies. In aluminium, companies compete to develop more efficient smelting technologies, a key competitive advantage, and have a clear disincentive to join efforts in that field.

The industry-led sectoral efforts that have been identified share features from all options under sectoral approaches - with the exception of SD-PAMs, never mentioned as such. However, some developing countries' objectives could, if such option were accepted by the UNFCCC Parties, be eligible as SD-PAMs. We also note that, while this may be driven by their participation in the EU emissions trading scheme, the iron-and-steel and cement sectors make carbon pricing an integral part of their approaches to foster higher GHG performance in their activities.

Instruments for quantitative sectoral approaches in heavy industry

Heavy industry has traditionally relied on benchmarks to identify best practice - how to produce a given volume of output with a minimum consumption of inputs. Benchmarks are useful in that they indicate actual room for efficiency improvements and barriers that stand in the way. But setting benchmarks is also a time-consuming and sometimes sensitive undertaking. The knowledge base for benchmarks is naturally in the hands of companies (that may not wish to share it with competitors), leading also to the problem of asymmetry of information between the regulated (industry) and the regulator (government). Some trust has to be established between industry and governments if benchmarks are to help guide policy-making on a sectoral basis.

Baselines - the adoption of some reference quantity of GHG per unit of industrial output (e.g. tCO₂ per tonne of steel) - could provide the basis for sector-wide crediting of GHG reductions. The evolution of the Kyoto Protocol's Clean Development Mechanism, sectoral crediting mechanisms (SCM) and the possibility for developing countries to commit to "no-lose sectoral pledges" have been researched extensively.⁴ A sector (i.e. a defined set of installations) that performs better than the baseline (x tonnes of CO₂ per unit of output) would be credited GHG emission reductions, for sale on the international market, to a Party that would need such reductions to achieve compliance. The institutional requirements for the implementation of such sector-based crediting are not trivial, however.

⁴ See Bosi and Ellis (2005), Ellis and Baron (2005), Baron and Ellis (2006), Schmidt et al. (2004), Schmidt et al. (2006b), Samaniego and Figueres (2002).

Sector-wide crediting raises two other issues:

- Moving to a sector-wide crediting mechanism could mean a much larger supply -eventually to be met with larger demand for the system to be effective.
- Crediting, as currently practiced under the CDM, represents a subsidy for non-Annex I installations, i.e. *potential* competitors, in the case of sectors considered here. Broadening crediting would not likely solve competitiveness concerns - unless more ambitious baselines were set in developing countries.

Whether they aim at setting objectives for improved performance at the country or transnational level, with or without the reliance on flexibility mechanisms, sectoral approaches need a measure of performance on which they can base common (or differentiated) objectives. Data collected for other IEA work reveals some important elements for industry emission baselines:⁵

- Differences in the average energy and CO₂ performance of heavy industrial activities could be interpreted *a priori* as an indication that energy/CO₂ savings are available. However, measures of performance must be based on similar boundary conditions to be valid. It is not always the case for data gathered at national level.
- Energy efficiency performance in competitive industries results naturally from prevailing energy prices. Incentives may be needed to achieve similar performance elsewhere.
- Regulatory and other barriers may hamper high energy efficiency. Governments may need to remove them in order to facilitate the uptake of less GHG-intensive practice.

More political dimensions, not studied here, would also affect how baselines may be set among various players. A baseline used as the objective for a “pledge-and-review” would probably differ from one used under a sector-based crediting system or any system with a price on CO₂ emissions. The flexibility to achieve goals at least cost through any trading mechanism may also influence stakeholders’ willingness to accept a more demanding baseline. How, and how quickly various players may be affected by the agreed policy instrument will also influence the level of the baseline, and its evolution over time. Last, the estimated marginal cost of the baseline will need to be compared with estimated costs in other sectors, as policy-makers ought to ensure that no sector is unduly penalised in comparison with others.

In summary, if baselines were designed as the basis for sectoral approaches at international level, they would need to rest on comparable data on international performance, but would eventually reflect other considerations. While recommendations can be put forward on the first aspect, the second is probably more a matter for negotiation among interested parties.

Issues for integration of sectoral approaches in future climate policy

The report also raises issues related to a possible negotiation of sector-based approaches, and how they could feed into a UNFCCC process, highlighting some of the legal aspects. These issues would play out differently under various governance systems:

- Industry could engage in a “pledge-and-review” mechanism, not requiring specific government endorsement or actual UNFCCC recognition.
- Industry-government agreements could foster mitigation across a broad set of countries and facilitate their engagement under the UNFCCC.

The question of integration in the UNFCCC hinges on what various parties expect from sectoral approaches. First and foremost, there is value in shoring up the discussion over emission objectives with

⁵ IEA (2007b), Tanaka (2007).

sectoral knowledge, be it to understand how much can be done, at what cost. In the end of course, the question of how the burden is to be shared is a negotiation matter.

Whether future commitments under the UNFCCC ought to be structured around sector-by-sector objectives is also a matter for Parties. The pros and cons of such approach are not studied in the present report. In the end, the right balance ought to be struck between any level of sectoral detail that the UNFCCC negotiation needs to cover, and the practicality of doing so in a setting gathering more than 180 Parties.

One can also envision a soft link from sectoral approaches to the UNFCCC, whereby discussions held outside the UNFCCC framework - see the various pledges by governments in APEC, G8, and industry-led initiatives - could feed back into countries' decisions on country-wide objectives. An approach that would successfully address competitiveness concerns would, for instance, probably facilitate engagement under the UNFCCC. At this stage of development of sectoral approaches - e.g. efforts undertaken by heavy industry, or the public-private partnership under APP - it is too early to estimate their contribution to future commitments.

Whereto next: a pilot phase for sectoral approaches?

With a myriad of possible options tabled by Parties and think-tanks, and some still evolving industry and public-private initiatives, the picture of sectoral approaches for GHG mitigation in heavy industry remains blurred - even if challenges are clear: the rapid growth in emissions outside Annex I countries, and competitiveness issues. In particular, no straightforward solution to the competitiveness concerns emerge at this stage. At the same time, efforts underway (from data gathering to international sharing of technology and policy best practice such as APP) should enhance public and private sector stakeholders' knowledge of sector specifics, a positive contribution at a time where countries are to embark on the negotiation of future commitments.

Three challenges lay ahead for the development of sectoral approaches to international GHG mitigation:

1. *Technical*: sectors need a fair record of their starting points, from an energy emissions and technology standpoint. Efforts are underway in the three sectors studied here. This may be more difficult for emerging economies, especially China with its large number of installations - and similar development is expected in India in the medium term.
2. *Institutional*: new international instruments may need to be developed (from sectoral pledges to crediting), some of which may raise significant issues for the international climate regime. Further, developing countries' ability to implement and enforce broad-based energy and environmental policies may be limited for some time. Enhancing capacity will be crucial in that respect.
3. *Political*: the international climate negotiations to date have been characterised by a rather antagonistic North-South debate, based on the principle that Annex I Parties must "*take the lead*". There are, however, possibilities to enhance economic development, energy efficiency, local and global environment quality through international collaboration and information sharing. It remains to be seen whether emerging economies faced with these challenges will consider some form of sector-based commitment at international level to unlock these win-win potentials. Sector-specific discussions, public and private, can only help to bring these potentials forward in the UNFCCC discussion.

First and foremost, it would be useful to estimate the GHG reduction potential of these approaches, on the basis of existing technologies, production capacities, regional market dynamics, and possible policy incentives - from the diffusion of best practice to a carbon price. This would help to identify the most productive avenue for sector-based efforts, whether they are embedded in existing policy instruments, or lead to new ones.

In the run up to the Kyoto Protocol, a pilot phase for *activities implemented jointly* provided important insights for the project-based mechanisms of the Protocol. A pilot phase could also be envisioned to go beyond the theoretical and abstract discussion of SA and to face the implementation issues mentioned above. Elements to be tested could include:

- The feasibility and usefulness of a common benchmark, or a common methodology to establish meaningful country-specific sectoral objectives, reflecting national circumstances and also a country's willingness to undertake meaningful reductions.
- Countries' institutional needs to implement sectoral emission objectives, and how such institutional needs are if GHG crediting were to be involved.
- An approach for international cooperation to encourage best practice (in policy and technology). Best policy practice may not be simply "transplanted" from a developed to a developing country. The feasibility of such policy ought to be tested, possibly with plant-level pilot projects in the country. Identifying and developing case studies to illustrate such an approach would certainly prove useful.