

ESRI Discussion Paper Series No.235

The merit of sectoral approaches in transitioning
towards a global carbon market

by

Noriko Fujiwara with Anton Georgiev and Monica Alessi

June 2010



Economic and Social Research Institute
Cabinet Office
Tokyo, Japan

The merit of sectoral approaches in transitioning towards a global carbon market

June 2010

Noriko Fujiwara
with contribution of Anton Georgiev and Monica Alessi

Centre for European Policy Studies (CEPS)
Brussels

Contents

Executive summary	1
1. Introduction	3
2. Industry-led transnational approaches	4
2.1 What drives industry towards transnational sectoral approaches?.....	4
2.2 Coverage	4
2.3 Boundary setting	5
2.4 Data collection and best practices	7
Data collection	7
Best practices	8
2.5 Potential roles of sectoral benchmarking	8
3. Sectoral crediting	8
4. Policy implications	10
4.1 Sectoral approaches in UN negotiations	10
4.2 Sectoral dimensions of EU climate policy	11
4.2.1 The EU's energy and climate package.....	11
4.2.2 Roles of sectoral benchmarks in the EU ETS	12
4.2.3 The EU's call for a sectoral crediting mechanism	13
4.3 Policies and measures in two emerging economies: Mexico and China	14
4.3.1 The untapped potential in emerging economies	15
4.3.2 Mexico	15
4.3.3 China	16
4.4 Sectoral dimensions of US climate policy	17
4.4.1 Federal cap-and-trade proposals	17
4.4.2 Regional Greenhouse Gas Initiative	20
5. How to strengthen the effectiveness of sectoral approaches?	21
5.1 Choice of performance metrics	21
5.2 Reporting.....	21
5.2.1 UNFCCC reporting requirements	22
5.2.2 Progress in measurement and reporting protocols	22
5.3 A compliance system for sectoral approaches	24
5.3.1 Compliance system of the Kyoto Protocol	24
5.3.2 A compliance system for sectoral approaches: An example of the EU ..	25
6. Sectoral approaches as part of the post-2012 framework	25
6.1 Decentralisation and flexibility in the post-2012 architecture	25
6.2 How can sectoral approaches fit into the post-2012 framework?	26
7. Concluding remarks	26
List of Acronyms	28
References	30
Appendix 1. Member-state GHG emissions in non-ETS sectors for the period 2013–20	34
Appendix 2. Increase in the share of allowances to be auctioned by member states	35
Appendix 3. Distribution of allowances to be auctioned by member states reflecting the early efforts of some member states	36

THE MERIT OF SECTORAL APPROACHES IN TRANSITIONING TOWARDS A GLOBAL CARBON MARKET

NORIKO FUJIWARA WITH ANTON GEORGIEV AND MONICA ALESSI*

Executive summary

The term ‘sectoral approaches’ means different things to different people. There are at least three main models of sectoral approaches: industry-led transnational initiatives linked to the deployment of sector-specific technologies; bottom-up developing country commitments, possibly combined with ‘no-lose’ targets; and a sectoral Clean Development Mechanism (CDM) or sectoral crediting with implications for carbon finance.

There are a number of industry-led transnational initiatives, including the Cement Sustainability Initiative (CSI) under the World Business Council for Sustainable Development as well as activities by the International Aluminium Institute and worldsteel (formerly the International Iron and Steel Institute). Each sector has developed parameters or formulae for the coverage of sub-sectors. There are also different stages involved in benchmarking: i) setting sector boundaries, ii) documenting current industry performance based on agreed metrics or key performance indicators, and iii) identifying best practices. Consideration of the complexity in setting the sector boundary and the feasibility of operation would be preconditions for allowing the future inclusion of a relevant sector in a cap-and-trade system. Datasets collected at an installation level throughout multinational corporations could be integrated in each sector. The sharing and diffusion of best practices among companies would increase operational efficiency. Similarly, the diffusion of technology within the sector could contribute to improving the performance of the least-efficient installations.

Sector no-lose targets aim at encouraging emission reductions in a given sector through a form of non-binding targets in developing countries, especially in emerging economies. A sector-crediting baseline would be established by a host country. Credits for reductions below that baseline would be issued and could be sold on the international carbon market. A sectoral crediting mechanism is seen as an instrument for scaling up financial flows to and investment in developing countries. Transition from sectoral crediting to sectoral trading is usually considered halfway on the evolution path towards a flexible mechanism, starting from the current CDM and going through the programmatic CDM, then eventually moving to a cap-and-trade scheme. These sectoral approaches are not necessarily assumed to be the best option but can be considered part of a transition towards a global carbon market. They could coexist with other policies or mechanisms.

* Noriko Fujiwara is a Research Fellow at Centre for European Policy Studies (CEPS) and Head of the Climate Change unit, Anton Georgiev is a Researcher at CEPS and Monica Alessi is a Programme Manager at CEPS. This Discussion Paper has evolved from N. Fujiwara with contribution of A. Georgiev and M. Alessi, *Study on a method that can set the “cap” on GHG emissions and optimally allocate allowances based on countries, industries, and installations*, a final report submitted to the Environmental Studies Group, Economic and Social Research Institute, Cabinet Office, Government of Japan in January 2009 and has incorporated an update. The author thanks Christian Egenhofer, a Senior Fellow at CEPS for his contribution to the project.

Unlike transnational initiatives, sectoral crediting or sectoral trading is to be implemented domestically in developing countries. Proponents of these approaches put more emphasis on the electricity and heating sector than those of industry-led transnational initiatives.

Sector-specific benchmarks form the potentially strongest link between the European Union's Emissions Trading Scheme (EU ETS) and sectoral approaches. First, sectoral benchmarks can be used for setting caps. In a subsequent phase (2013–20), the European Commission will be in charge of setting an EU-wide cap. The cap will decrease annually by a linear factor compared with the average annual quantity of allowances issued by member states. Second, sectoral benchmarks can be used for free allocation. The benchmarks will be set Community-wide *ex ante*, and calculated for products. Third, sectoral benchmarks can become a catalyst for linking carbon markets. One option is to link carbon markets through agreements to provide for the recognition of allowances between the EU ETS and 'compatible mandatory' emissions trading schemes with absolute caps in any non-EU country or in sub-federal or regional entities. Another option is to link carbon markets through non-binding arrangements to provide for administrative and technical coordination in relation to allowances in the EU ETS or other 'mandatory' emissions trading schemes with absolute caps.

The EU calls for the creation of a carbon market across the OECD through linkages by 2015, which will be extended to include major emerging economies by 2020. As a step towards developing the global carbon market, it envisages a gradual phase-out of the project-based CDM for advanced developing countries in a move towards a sectoral crediting mechanism. This move would pave the way for introducing and developing cap-and-trade schemes in these countries.

There would be at least three ways to strengthen the effectiveness of sectoral approaches: through the choice of performance metrics, reporting and compliance. The possible discrepancy between indicators for energy use and greenhouse gas (GHG) emissions is an example of the problems with performance metrics. One approach is to use a composite index system. A rough framework, possibly adopting the index approach and based on what would be possible to measure, could be negotiated. Measurability would be essential for making sectoral approaches operational as part of a post-2012 framework and is likely to require a common scientific scale of measurement, including performance indicators and boundaries. For this purpose, the process underway through the UN Framework Convention on Climate Change (UNFCCC) could be complemented by the work of the International Organisation for Standardization/International Electrotechnical Commission and the International Energy Agency. An example of a functioning compliance system can be found in the EU ETS; compliance systems are much weaker when based on an effort-sharing decision that requires member states to reduce emissions from non-ETS sectors.

Some preliminary thinking points to the possibility of an increase in decentralisation and flexibility in the post-2012 architecture. Decentralised or 'bottom-up' approaches would rely heavily on the correct conduct of measurement, reporting and verification of mitigation actions in developing countries to ensure that the resources provided by developed countries are spent effectively. Sectoral approaches could work together with the targets-and-timetables approach or with a pledge-and-review model. Otherwise, an 'action-based' strategy, which covers sectoral approaches, can be regarded as a way of integrating targets and timetables, as they are agreed, with consistent and comparable policies and measures. Since the UNFCCC is a framework agreement with a longer time horizon as well as a wider coverage of participating countries, its scope allows a broader range of issues, including mitigation tools, under a single umbrella. Hence, sectoral approaches could have a better chance of developing into part of the post-2012 framework under the UNFCCC than under the Kyoto Protocol. There will be a hybrid range of agreements and mechanisms to make sectoral approaches operational. The simplest option is to have only intergovernmental agreements, such as a reporting protocol, as an extension of the UNFCCC requirements. The other option is to have both intergovernmental agreements and

agreements negotiated between the government and industry in each entity. Moreover, intergovernmental agreements would provide not only for guidelines for domestic legislation and regulations but would also set up international mechanisms to reduce the unevenness of distributional impacts or increase access for those with less resources to implement policies and measures. This combination would make the implementation of domestic measures more enforceable.

In conclusion, the research shows that sectoral approaches could contribute to the development of a method that could optimally set a cap on GHG emissions and allocate emission allowances, especially (but not exclusively) through benchmarking. Sectoral benchmarking could be built upon improvements in boundary setting and data collection, along with best practices. Yet, views over the costs associated with and the capacities for sectoral benchmarking differ from country to country, especially between developed countries and emerging economies or developing countries that are ‘economically more advanced’.

1. Introduction

Sectoral approaches are regarded as having the potential to broaden the range of contributions by all parties, including emerging economies, to emission reductions in greenhouse gases (GHGs), and to help moderate competitiveness concerns in trade-exposed industries. In particular, such approaches may help to identify emissions on a sector-by-sector basis and build confidence that policies and measures can be put in place to reduce emissions. They can also help identify national or global commitments through the aggregation of sectoral data, if countries so wish.

There are different models of sectoral approaches across sectors (e.g. Bodansky, 2007). Egenhofer and Fujiwara (2008b) identified at least three main models of sectoral approaches: industry-led transnational initiatives linked to the deployment of sector-specific technologies; bottom-up developing country commitments, possibly combined with ‘no-lose’ targets; and a sectoral Clean Development Mechanism (CDM) or sectoral crediting with implications for carbon finance. Nevertheless, all the models attempt to combine the following three objectives:

- Induce changes to technologies through either the development of new and breakthrough technologies or the accelerated deployment of existing technologies, essentially by means of cooperation among firms.
- Reduce the unevenness of distributional impacts among firms for the same aspect, which may arise as a result of uncoordinated local, national or regional climate-change policies.
- Engage developing countries in reducing emissions and taking on emission-reduction commitments.

The preconditions to achieve these objectives are as follows:

- data collection on the present state of the sector, e.g. emissions (actual and projected), information on the applied technologies, technology benchmarks and best practices;
- the identification and spread of best practices; and
- the development and diffusion of technology.

This paper considers models of sectoral approaches (sections 2 and 3) and the policy implications of such approaches (sections 4, 5 and 6). In looking at industry-led transnational initiatives, the paper describes the progress in work on benchmarking in section 2. This model is compared with the concept of sectoral crediting in section 3. Section 4 gives an overview of UN negotiations and the sectoral dimensions of recent policy developments in the EU, examples of two emerging

economies (Mexico and China), and the US (which has not ratified the Kyoto Protocol). Section 5 addresses the question of how to strengthen the effectiveness of sectoral approaches. Section 6 briefly discusses the challenge of how to develop sectoral approaches as part of the post-2012 framework. Section 7 contains some concluding remarks.

2. Industry-led transnational approaches

Industry-led transnational initiatives are particularly important in light of their participation, momentum or public exposure. This section addresses challenges to transnational approaches, especially related to boundary setting, data collection and best practices in benchmarking. In this context, this paper mainly looks at initiatives developed by industry and also touches upon an example of a public-private partnership, the Asia-Pacific Partnership on Clean Development and Climate (APP), as well as support for the G8 provided by the International Energy Agency (IEA).

2.1 What drives industry towards transnational sectoral approaches?

Current initiatives for industry-led, transnational sectoral approaches (e.g. aluminium, cement and steel) are driven by twin motives:

- moderating concerns about carbon leakage in those industry sectors exposed to international competition, owing to asymmetric carbon constraints imposed by uncoordinated domestic policies and measures; and
- expanding the scope of GHG emission reductions, especially in emerging economies, through sector-specific objectives and instruments.

The rationale for differentiation between Annex I and non-Annex I parties to the UN Framework Convention on Climate Change (UNFCCC) has recently grown weaker in energy-intensive industry sectors that are exposed to international competition, such as aluminium, steel, cement, paper and pulp, and organic chemicals. Major companies operating in these sectors in Annex I and non-Annex I parties are broadly comparable, except on the availability of county-specific resources (e.g. natural gas versus coal or raw material inputs) and the ownership of technologies (Egenhofer and Fujiwara, 2008b). Nonetheless, the levels of carbon constraints vary significantly because the domestic policies and measures in Annex I parties are generally linked to their Kyoto Protocol targets, while non-Annex I parties are not bound by quantitative emission-reduction commitments under the Protocol.

Transnational sectoral approaches are expected to become a promising tool to address this dilemma as part of a post-2012 agreement. On the one hand, these approaches could help close the growing gap between developed and emerging economies in the levels of carbon constraints imposed on competing companies through respective policies and measures. In so doing they would ease the concerns about carbon leakage strongly felt in the industry sectors exposed to international competition. On the other hand, they could in effect expand the scope of enhanced mitigation actions to emerging economies through sector-specific objectives and instruments integrated with domestic policies and measures. Cooperation on enhanced mitigation actions in industry sectors across countries can be further promoted to develop and deploy advanced technologies and to remove identified barriers to technology development and deployment.

2.2 Coverage

There are a number of industry-led transnational initiatives for sectoral approaches. The cement, aluminium, and iron and steel sectors have set up their respective initiatives: the Cement Sustainability Initiative (CSI) under the World Business Council for Sustainable Development

(WBCSD), activities of the International Aluminium Institute (IAI) and those of worldsteel (formerly the International Iron and Steel Institute). The CSI initiative in the cement sector has 23 major international companies as members, which produce cement in more than 100 countries. CSI member companies and their affiliates represent over 40% of global cement manufacturing.¹ The IAI has 27 member companies worldwide, which are responsible for 80% of world aluminium production.² A number of non-member companies also submit annual GHG-related data. Worldsteel represents approximately 180 steel producers (including 19 of the world's 20 largest steel companies), national and regional steel-industry associations, and steel research institutes. Worldsteel covers around 85% of the world's steel production.³

Other than industry-led initiatives, public-private partnerships could also play a role in developing transnational sectoral approaches. The APP consists of seven partner countries – Australia, Canada, China, India, Japan, the Republic of Korea and the United States. Under the APP are sectoral taskforces representing three energy-supply sectors (cleaner fossil energy, renewable energy and distributed generation, power generation and transmission) and five energy-intensive sectors (steel, aluminium, cement, coal mining, buildings and appliances).

2.3 Boundary setting⁴

All the initiatives underway promote the collection of information about the status of a sector in a transparent way, for example, based on different stages in benchmarking.⁵ In a sector-specific initiative, drawing a boundary is the first step to benchmarking and a pre-condition for data collection. Boundary setting draws a limit around what can be measured against pre-determined criteria.

1. *The product of a company's activity in a sector, especially if emissions performance is to be measured per unit of output*

Standardised single-product outputs such as kWh electricity or tonne of clinker (cement sector) are easy to identify sector-wide while multiple products by each plant, such as petrochemicals and steel products, make it hard to decide on a common denominator, especially if the product mix evolves with time. It is also necessary to decide whether cement or concrete, instead of clinker, can be regarded as the final product in order to incorporate the use of other materials and off-site operations.

2. *Whether and how far to go upstream and downstream in the product lifecycle and the industry value chain*

¹ See the web page, the World Business Council for Sustainable Development, Cement Sustainability Initiative, "About the CSI"

http://www.wbcdcement.org/index.php?option=com_content&task=view&id=35&Itemid=90

² See the International Aluminium Institute web page, "About IAI"

<http://www.world-aluminium.org/About+IAI>

³ See the worldsteel web page, "History and objectives"

<http://www.worldsteel.org/?action=storypages&id=13>

⁴ This section is primarily based on the results of the "Technical workshop on sectoral approaches: Benchmarking, sector boundary and monitoring, reporting & verification issues", Brussels, 17-18 September 2008, carried out in the context of the study on *Global sectoral approaches as part of the post-2012 framework*, supported by the European Commission, DG Enterprise and Industry.

⁵ Benchmarks can be generally understood as pre-determined performance levels against which companies or an entire sector compare their performance. Performance can be expressed in terms of agreed indicators such as CO₂ emissions per unit of industrial production.

The aluminium sector places an emphasis on recycling and scrap utilisation in the methodologies of the existing voluntary initiatives that could deliver emission savings. There will also be an impact on emissions from final consumer products. For example, making cars and trains more lightweight would lead to significant emission reductions. The Chinese iron and steel sector has suggested incentivising the creation of an integrated steel plant at the centre of an eco-industrial chain because, depending on its vertical integration, a single company may have a significant impact on emissions elsewhere along the chain. Upstream activities involving fuel use and transport for intermediate products could be accounted for as well. For example, shifting from coal to natural gas for on-site fuel could result in a higher carbon footprint for upstream operations, especially if liquefied natural gas is used.

3. *How to deal with indirect emissions*

One of the key issues is if electricity is used instead of combusting fuel in certain sectors, e.g. aluminium, or certain processes, e.g. those in the iron and steel sector. There may be a guiding principle that could be applied: while power generators are able to control the fuel and GHG mix, the producers are able to control the amount of power they use. This has implications for choosing energy use rather than GHG emissions as a performance indicator for certain sectoral benchmarks. In this respect, it is necessary to decide how to reward on-site electricity co-generation, such as combined heat and power or even renewable sources. There have been some precautionary efforts to avoid including indirect and off-site emissions and thus to prevent double counting.

The energy input for a single product may differ according to the technology and corresponding process used, such as wet versus dry for cement clinker, but also for electricity, where sometimes several options exist for each fuel source. Especially in the iron and steel sector, it is important to draw statistical and system boundaries around processes for precision, but their variance by process complicates benchmarking. Differentiating benchmarks by process may discourage shifts towards more efficient technologies. Another option is to concentrate on technology benchmarks.

4. *Determining which installations or sectors are to be compared*

Comparisons of installations or a sector may be regional, national or international. Existing industry-led initiatives centre on the international level. The best performers would be rewarded regionally or nationally, but comparison at these levels may not mitigate concerns about international competition or distortions to the market. At the international and national levels, the least-developed countries (LDCs) and very small producers could be completely excluded from comparison, as investments in state-of-the-art technology may make no economic sense with a negligent impact on their emissions.

Consequently, sectoral characterisation, including boundaries and configuration, has important implications for the potential benefits of sectoral approaches. Poor choices for boundaries and metrics would limit the potential benefits by overlooking attractive opportunities for mitigation, failing to count in certain positive actions, rewarding unproductive activities or creating ‘gaming’ opportunities, thereby undermining confidence. Sector characterisation should be determined in a manner that promotes consistency, avoids double counting, reflects real plant conditions, is consistent with measurement protocols and data collection capabilities, and can be reproduced and accepted by all parties.

Consideration of the complexity involved in boundary setting and the feasibility of operation would be preconditions for allowing the future inclusion of a relevant sector in a cap-and-trade system. Boundary setting needs to address the complexity as described in the above criteria, capturing some, if not all of the criteria. It may be worthwhile keeping this practice simple for

international negotiations, but leaving it open to change according to developing countries' national circumstances in the future.

2.4 Data collection and best practices

There are two more stages in benchmarking: documenting current industry performance on agreed (simple) metrics or key performance indicators; and identifying, sharing and diffusing best practices, i.e. comparing the performance of equipment or plants with best practices.

Data collection

Initially, the CSI focused on a data collection exercise called 'Getting the Numbers Right', including the development of a database for existing technologies in the sector and a benchmarking system. The CSI's data collection covers all countries and regions in which members run clinker, cement and grinding operations to give an accurate indication of CO₂ emission levels and energy efficiency in the sector. In the first cycle of data collection, member companies submitted data for the years 1990, 2000 and 2005. Data on CO₂ emissions and energy performance were collected according to the pre-determined parameters.⁶ The latest modelling exercise based on the data has recently been published, analysing the impact of climate policies on the sector (WBCSD, 2009).

The central pillar of the IAI's approach is a database and analysis. The data cover 80% of world production and the coverage is being expanded. The industry will report regularly on its global recycling performance (IAI, 2009).

Worldsteel has had a data collection programme since 2008 and a climate-action recognition programme since 2009. Their CO₂ data collection programme enables every steel-producing company to submit its CO₂ emissions according to a standardised methodology. This measurement framework covers key factors influencing CO₂ emissions and energy use. In the same year, more than 180 steel-producing sites contributed to this exercise. The database now holds CO₂ and energy-intensity data for nearly 40% of global steel-production capacity. In addition, the climate-action recognition programme recognises steel producers that have met their commitment to participating in worldsteel's CO₂ emissions data-collection programme. Two-thirds of the association's membership participated in the first round of data collection before early 2009 (worldsteel, 2009).

Given these current initiatives, the datasets collected at an installation level throughout multinational corporations could be integrated in each sector. This approach would allow governments to better assess targets, the technical potential for meeting them and the associated costs in each sector. In cooperation with industry and other sectors, the International Energy Agency (IEA) developed indicators to provide the latest data and analysis worldwide on energy use and efficiency improvements (IEA 2008).

Further work needs to focus on the measurement, monitoring and verification of data on emissions or energy use against the pre-determined baselines and associated costs. Only verified data can ensure that industry sectors' commitments, whether unilaterally set or negotiated with governments, would lead to real and measurable emission reductions beyond a business-as-usual

⁶ These parameters include specific gross and net CO₂ emissions per tonne clinker, cement and cement product; absolute gross and net CO₂ emissions; thermal energy consumption per tonne clinker; electric energy consumption per tonne cement; fuel mix (fossil fuel/fossil alternative fuels and raw materials/biomass); and clinker-to-cement ratio.

(BAU) scenario. Objective data on emissions and technologies can be used to assess the performance of existing installations and to identify future potential to reduce emissions.

Best practices

The next stage in benchmarking is identifying, sharing and diffusing best practices among companies to increase operational efficiency. The diffusion of technology within a sector could contribute to improving the performance of the least-efficient installations. In one example, upon the G8's request the IEA presented a proposal for an initiative including dissemination of good practice and capacity building, and reported progress with implementation of energy efficiency policies in G8 countries.⁷ In another, the APP sectoral taskforces produced a set of handbooks for dissemination: a *Green Handbook Peer Review* prepared by the Power Generation and Power Distribution Task force (FEPC, 2007) to describe best practices for power generation; and a *State-of-the-Art Clean Technology Handbook* by the Steel Taskforce (Lawrence Berkeley National Laboratory and American Iron and Steel Institute, 2007) to describe best available energy-saving technologies and practices in the iron & steel sector.

2.5 Potential roles of sectoral benchmarking

Egenhofer and Fujiwara (2008b) identify four potential roles that sectoral benchmarking could play in the development of a global carbon market:

- If sectoral performance benchmarks are based on best practices or the best available technology in a sector, they could be used for setting a cap on emissions.
- Sectoral benchmarks could also be used for allocation, at least as long as free allocation continues.
- The linkage of carbon markets would be facilitated and accelerated by coordination in central design options such as cap-setting, (free) allocation and the monitoring, reporting and verification of emissions. Sectoral approaches, notably sectoral benchmarking, could facilitate such coordination.
- A bottom-up and sectoral approach would gather and provide more robust and more reliable data that could be used to formulate post-2012 commitments by developed countries.

These four potential roles of sectoral benchmarking have policy implications. The first three points are examined in light of the EU's view (see section 4.2.2). The fourth point supports proposals for further commitments by developed countries and bottom-up country commitments by emerging economies (see sections 4.2-4.4).

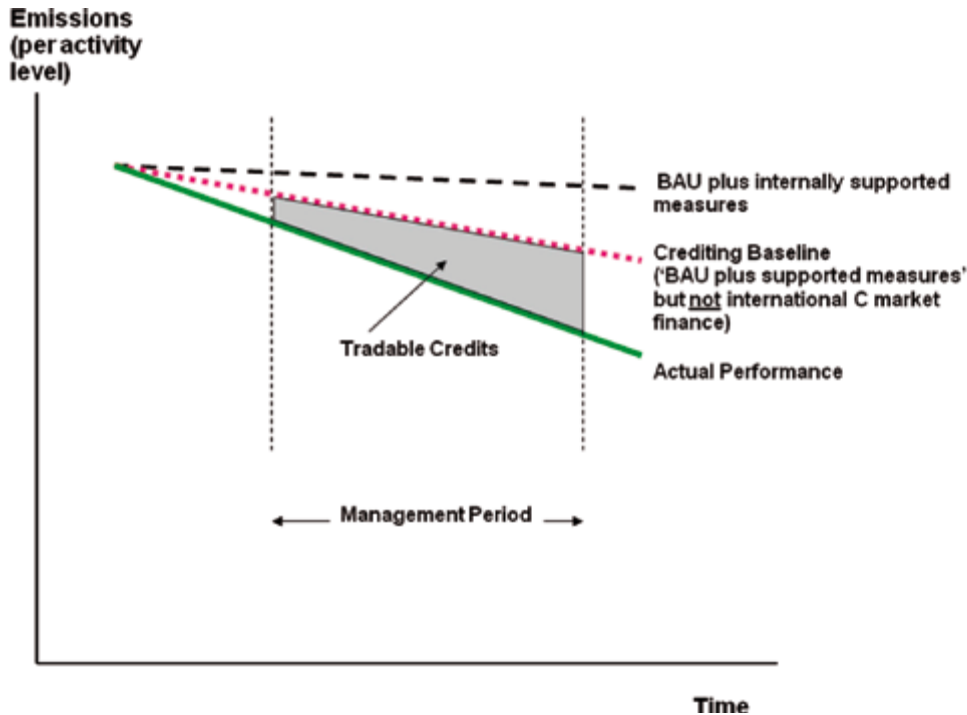
3. Sectoral crediting

Sector no-lose targets (SNLTs) aim at encouraging emission reductions in a given sector through a form of non-binding targets in developing countries, especially in emerging economies. There would be no penalty for not reaching the target, hence the term 'no lose'. A sector crediting baseline would be established by a host country, in i) intensity goals in terms of the emissions intensity of the sector as a whole, e.g. tonnes CO₂ (tCO₂) per tonne of output or per MWh of electricity; ii) fixed emission goals in terms of an absolute total quantity of GHG emissions; or iii)

⁷ IEA, "Global Energy Efficiency Action Initiative" and "Progress with implementing energy efficiency policies in the G8", both prepared for the G8 summit in Italy in July 2009 (retrieved from www.iea.org/G8/index.asp).

technology-based objectives (e.g. Baron et al., 2009; Schneider and Cames, 2009). Most of the existing proposals assume that the sectoral crediting baseline would be set well below the BAU emissions for the mechanism to increase financial flows and mitigation actions. Credits for reductions below that baseline would be issued and sold on the international carbon market (see Figure 1).

Figure 1. Simple depiction of a sectoral crediting baseline



Source: Ward et al. (2008).

A sectoral crediting mechanism is seen as an instrument for scaling up financial flows to and investment in developing countries. Transition from sectoral crediting to sectoral trading is usually considered halfway on the evolution path towards a flexible mechanism, starting from the current CDM and going through the programmatic CDM, then eventually moving to a cap-and-trade scheme with binding absolute reductions (e.g. Schneider and Cames, 2009; Baron et al., 2009; Aasrud et al., 2009; Fujiwara, 2009; Youngman and Diamant, 2010). These sectoral approaches are not necessarily assumed to be the best option but can be considered part of a transition towards a global carbon market. They could coexist with other policies or mechanisms.

The sector target for a host country could either be negotiated internationally at the level of the Conference of the Parties to the UNFCCC as part of a comprehensive post-2012 agreement (Ward et al., 2008) or based on benchmarks to be determined by independent experts for an industry sector (Schmidt et al., 2006). One merit of sectoral crediting is that they circumvent the need for proof of additionality, one of the main problems associated with the current CDM. An open question is whether to issue credits to companies performing below the sectoral baseline or issue them to the host government.⁸

Unlike transnational initiatives, sectoral crediting or sectoral trading is to be implemented domestically in developing countries. Proponents of sectoral crediting and sectoral trading put

⁸ For other design elements, see e.g. Youngman and Diamant (2010) and IETA (2010).

more emphasis on the largest sector for global GHG emissions, the electricity and heating sector, than those of industry-led transnational initiatives (see e.g. Amatayakul et al., 2008).

4. Policy implications

Based on an understanding of how the models of sectoral approaches could work, this section gives an overview of the sectoral dimensions of recent policy developments, starting with the UN negotiations, turning to the EU, two emerging economies (Mexico and China) and closing with the US, at both the federal and regional levels.

4.1 Sectoral approaches in UN negotiations

In the Bali Action Plan,⁹ parties to the UNFCCC (or the ‘Convention’) agreed to launch a two-year negotiation process with a deadline for conclusion of a comprehensive agreement in Copenhagen in December 2009, setting out guidance, direction or destination. For this purpose they set up a new Ad-hoc Working Group on Long-term Cooperative Action (AWG-LCA) under the Convention.

The Working Group has discussed two types of sectoral mechanisms – sectoral crediting and sectoral trading – under Art. 1(b)(v) of the Bali Action Plan, more specifically “various approaches, including opportunities for using markets, to enhance the cost-effectiveness of, and to promote, mitigation actions”. In addition, the transnational approach was initially addressed in the context of Art. 1(b)(iv) of the Bali Action Plan, which notes the consideration of “cooperative sectoral approaches and sector-specific actions, in order to enhance implementation of Art. 4, paragraph 1(c), of the Convention”.¹⁰ Yet, it has been proposed that cooperative sectoral approaches should be associated with nationally appropriate mitigation actions (NAMAs) by developing countries (e.g. Aasrud et al., 2009) and that sectoral approaches should address emissions that cannot be attributed to any particular economy (e.g. international aviation and maritime transport).¹¹

In Copenhagen, the parties agreed to extend the mandate of the AWG-LCA. Moreover, a large majority of parties supported the Copenhagen Accord.¹² Art. 1(b)(v) of the Bali Action Plan on various approaches has been incorporated into Item 7 of the Copenhagen Accord, which became operational immediately. This guidance provided in the Copenhagen Accord needs to be substantiated and translated into practical decisions in Cancún in December 2010 or thereafter.

⁹ See Decision 1/CP.13, “Bali Action Plan” in the *Report of the Conference of the Parties on its thirteenth session*, held in Bali from 3 to 15 December 2007, Addendum, Part two: Action taken by the conference of the Parties at its thirteenth session, UN Framework Convention on Climate Change, FCCC/CP/2007/6/Add.1, 14 March 2008.

¹⁰ Art. 4.1(c) of the Convention requires governments to “promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors”.

¹¹ See Non-Paper No. 49, Contact group on enhanced action on mitigation and its associated means of implementation, subgroup on paragraph 1(b)(iv) of the Bali Action Plan (Cooperative sectoral approaches and sector-specific actions), 6 November 2009.

¹² See Decision 2/CP.15, “Copenhagen Accord” in the *Report of the Conference of the Parties on its fifteenth session*, held in Copenhagen from 7 to 19 December 2009, UN Framework Convention on Climate Change, FCCC/CP/2009/11/Add.1, 30 March 2010.

4.2 Sectoral dimensions of EU climate policy

4.2.1 *The EU's energy and climate package*

In January 2008, the European Commission presented a package of legislative proposals to achieve a target of reducing GHG emissions by 20% below 1990 levels by 2020 (which will be raised to a 30% reduction if there is a new international agreement for the post-2012 period) and an increase in the share of renewable energy to 20% by 2020. The package included proposals for strengthening and broadening the EU's Emissions Trading Scheme (EU ETS) from 2013 and for sharing the emissions reduction effort in non-ETS sectors among member states. In December these proposals were approved by both the European Council and the European Parliament, meeting the initial timeframe.

Dividing mitigation efforts between the sectors in the EU ETS and the non-ETS sectors is one sectoral dimension of the package. The EU ETS mainly covers electricity and industry sectors. Non-ETS sectors include agriculture, transport, buildings and households. More precisely, the EU translates the overall target of a 20% cut from 1990 levels into a 14% reduction from 2005 levels, and further breaks down the 14% target into a 21% reduction in GHG emissions below 2005 levels for the ETS sectors and a 10% reduction for the non-ETS sectors, ranging from -20% to 20% across member states. Non-ETS sectors are subject to 'effort sharing' among member states (for individual limits on member-state GHG emissions, see appendix 1), whereby commitments are differentiated according to an economic efficiency approach (i.e. least cost) and a wealth indicator (i.e. relative wealth).

Another sectoral dimension is to assign a single EU-wide cap but apply different allocation methods by ETS sector (e.g. the power sector and industry sectors) for a transition period. For electricity generation, full auctioning will be introduced from 2013. A compromise has been reached, however, for a transitional free allocation of allowances in the sector under certain conditions, which will primarily apply to the new member states. Free allocation for the modernisation of electricity generation must not exceed 70% in 2013 and will decrease to nil in 2020. For the industrial sector, auctioning will be phased in over a period of time: in 2013 installations will receive 80% of allowances free, then 30% by 2020 and nil (i.e. full auctioning) in 2027.

Moreover, against the background of growing concerns about carbon leakage and according to Art. 10a (13) of Directive 2009/29/EC,¹³ the European Commission identified the industry sectors that are considered particularly exposed to international competition at the end of 2009 (European Commission, 2010a). These sectors would receive free allocation for a limited period. There were difficulties in deciding the timing of such an announcement because the EU did not want to reveal precise figures prematurely (e.g. the amount of free allowances) to its negotiating partners.

The next section looks more closely at the role of sectoral benchmarks in cap setting, the allocation of allowances and linking with other emissions trading schemes.

A further dimension is to include the aviation sector in the EU ETS. In February 2009, an EU Directive (2008/101/EC) incorporating aviation into the EU ETS entered into force.¹⁴ From 2012

¹³ European Parliament and Council of the European Union, Directive 2009/29/EC of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community, *Official Journal of the European Union*, L 140/63-87, 5 June 2009(a).

¹⁴ European Parliament and Council of the European Union, Directive 2008/101/EC of 19 November 2008 amending Directive 2003/87/EC to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, *Official Journal of the European Union*, L 8/3, 13 January 2009(c).

aviation activities will participate in the ETS. All flights landing or taking off from airports in the EU will be covered. The Directive aims at capping GHG (initially CO₂) emissions from the aviation sector to 3% below the average of 2004–06 annual emission levels in 2012 and tightening the cap to 5% below the base-year levels for the 2013–20 period (Art. 3d.1-2). Initially 15% of the allowances will be auctioned and this percentage may be increased following the review of the Directive. Each member state will be able to decide on the use of auctioning revenues (Art. 3d.4).

4.2.2 Roles of sectoral benchmarks in the EU ETS

Egenhofer and Fujiwara (2008a) explore possibilities for linkages between the EU package, especially the EU ETS, and sectoral approaches. Sector-specific benchmarks form the potentially strongest link between them. In the ETS, the benchmarks developed through sectoral approaches could play a role in cap setting or the allocation of allowances, and more generally in the expansion of carbon markets.

First, if sectoral benchmarks are based on best practices or the best available technology in a sector, they can be used for setting a cap on emissions. In further guidance for the second phase (2008–12) of the EU ETS, the European Commission regarded GDP growth and carbon intensity as two of the most important factors driving emission trends, explicitly using the potential for carbon-intensity improvements to assess the member states' caps and 'objective' projections based on 2005 verified emissions across the board for all member states.¹⁵

Art. 9 of Directive 2009/29/EC signals the change in responsibility for cap setting from individual member states to the European Commission from the third phase (2013–20) onwards.¹⁶ A single EU-wide cap will be placed on annual GHG emissions. The annual cap will decrease by a linear factor of 1.74% compared with the average annual quantity of allowances issued by member states in accordance with the Commission's decisions on their national allocation plans for the second phase. By the end of June 2010, the Commission will publish the absolute EU-wide cap for 2013 based on the total quantities of allowances issued or to be issued by the member states. The Commission will review the linear factor and submit a proposal as from 2020 with a view to having a decision by 2025. The new approach, adoption of a linear decrease in annual caps, means simplification in cap setting and an increase in predictability.

Second, sectoral benchmarks can be also used for allocation, provided that free allocation continues. Art. 10a of the Directive makes explicit reference to "Community-wide *ex ante* benchmarks" in considering transitional EU-wide rules for harmonised free allocation.¹⁷ This decision intends

to ensure that allocation takes place in a manner that gives incentives for reductions in greenhouse gas emissions and energy efficient techniques, by taking account of the most efficient techniques, substitutes, alternative production processes, high efficiency cogeneration, efficient energy recovery of waste gases, use of biomass and capture and storage of carbon dioxide, where such facilities are available, and shall not give incentives to increase emissions.

The Directive also notes that the (sub-)sectoral benchmarks will be calculated for products rather than for inputs in order to maximise GHG emission reductions and energy savings throughout

¹⁵ Communication from the Commission, Further guidance on allocation plans for the 2008 to 2012 trading period of the EU Emissions Trading Scheme, COM(2005) 703 final, 22 December 2005.

¹⁶ See Directive 2009/29/EC of the European Parliament and Council of the European Union (2009a), *op. cit.*

¹⁷ *Ibid.*

each production process of the sector or sub-sector concerned. The starting point for setting *ex ante* (sub-)sectoral benchmarks, according to the agreement, will be the average performance of the 10% most efficient installations in a sector or sub-sector in the Community in the years 2007–08.

Third, sectoral benchmarks can become a catalyst for linking carbon markets. Art. 25 of the Directive suggests two possibilities for agreements in general and non-binding arrangements.¹⁸ One option is to link emissions trading schemes through agreements to provide for the recognition of allowances between the EU ETS and ‘compatible mandatory’ GHG emissions trading schemes with absolute emissions caps established in any non-EU country or in sub-federal or regional entities. Another option is linking through non-binding arrangements with these partners to provide for administrative and technical coordination in relation to allowances in the EU ETS or other ‘mandatory’ GHG emissions trading schemes with absolute emissions caps. Driven by an ambition to develop a global carbon market through linking the EU ETS with other domestic cap-and-trade schemes, the EU launched the International Carbon Action Partnership together with other countries preparing for emissions trading schemes.

The EU has called for the creation of a carbon market across the OECD through linking by 2015, and its expansion to include major emerging economies by 2020 with a view to building a global carbon market. Section 4.4 of this paper looks at recent developments in US legislation for a federal cap-and-trade scheme, and the launch of a regional cap-and-trade scheme, known as the Regional Greenhouse Gas Initiative (RGGI). While linking will likely require adjustments in design options among different schemes, it could facilitate sectoral cooperation across countries, especially a move to develop global sectoral benchmarks.

4.2.3 *The EU's call for a sectoral crediting mechanism*

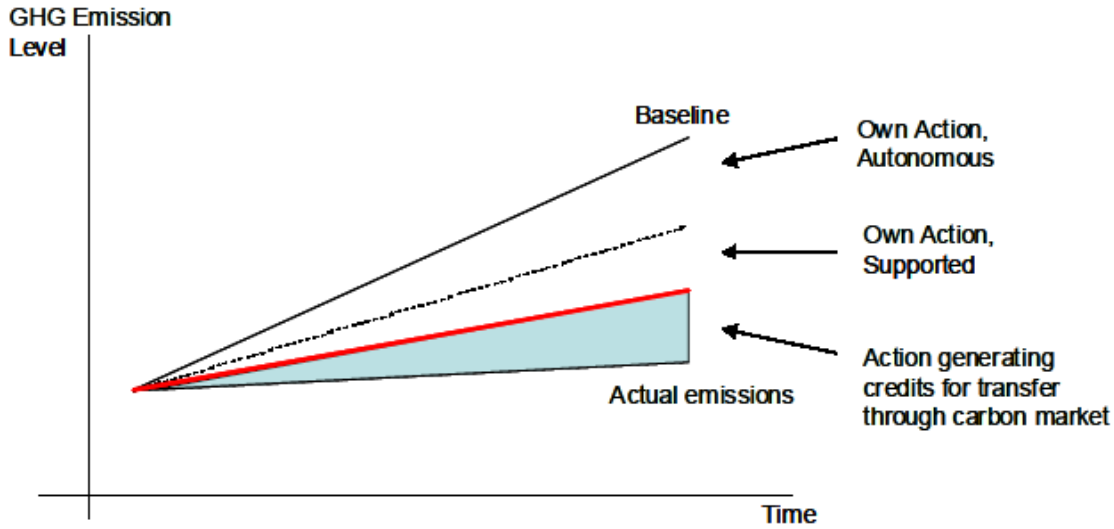
In association with the Copenhagen Accord, the EU reiterated its emissions reduction target of a 20% reduction from 1990 levels by 2020 and its conditional offer to move to 30%, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities. The EU is currently examining the possibility of adjusting the 2020 GHG emissions target from 20% to 30% reductions, which would alter the assumption of the amended ETS Directive and the effort-sharing decision¹⁹ regarding use of CERs/ERUs in the third phase. Ahead of the June European Council meeting, the European Commission has been asked to outline a pathway for the EU's transition to a low carbon economy by 2050, develop an analysis of milestones on the pathway to 2050 and prepare an analysis of policies that would be needed to achieve a 30% emissions reduction. The Commission will also present its analysis on the state of energy-intensive industries at risk of carbon leakage with regard to their access to free allocation for the ETS in the third phase (European Commission, 2010b).

As a key element of the future agreement, the EU stresses the role of a strengthened global carbon market and aims at developing an OECD-wide market by 2015 and beyond by 2020. One of the promising approaches for the development of a global carbon market would be a new sectoral crediting mechanism that takes into account the different capabilities of developing countries (see Figure 2 and European Commission, 2009a, 2009b and 2010b).

¹⁸ Ibid.

¹⁹ European Parliament and Council of the European Union, Decision No. 406/2009/EC of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, *Official Journal of the European Union*, L 140/136-148, 5 June 2009(b).

Figure 2. Developing country emissions



Source: European Commission (2009a).

As a way of ensuring environmental integrity and improving effectiveness and governance, the EU has proposed a reform of the CDM. For advanced developing countries and in highly competitive economic sectors, the EU suggests that the project-based CDM should be phased out, in a move towards a sectoral crediting mechanism. The CDM would be kept only for LDCs. This move would also pave the way for the introduction and development of cap-and-trade schemes in developing countries that are economically more advanced. New flexible mechanisms are seen as a necessary future step in developing countries' increasing contributions to global mitigation efforts and in scaling up financial flows to these countries for their action. The European Commission suggests that the EU ETS legislation²⁰ should be used to incentivise the development of sectoral market mechanisms and to promote the CDM reform (European Commission, 2009b and 2010b).

The EU's call for a sectoral crediting mechanism presents a set of more concrete research questions. Is deviation from the BAU achievable with host countries' own resources or with international support? Their marginal abatement costs will possibly remain lower than those in developed countries. Is the suggested figure politically acceptable, especially to developing economies? Do they have sufficient financial resources and appropriate technologies to achieve the proposed level of emission reductions? If not, how can finance be increased while prioritising the delivery of limited resources? A related challenge is how to motivate the private sector in scaling up of finance. The last but most important question is whether sectoral crediting mechanisms would be the best instrument to address these concerns.

4.3 Policies and measures in two emerging economies: Mexico and China

Following the above questions about the ability of sectoral crediting mechanisms to address concerns such as financial needs, cost-efficiency and political acceptability, this section turns to

²⁰ See Arts. 11a(5) and 11a(9) of the EU ETS Directive (2009/29/EC, European Parliament and Council of the European Union, 2009(a), op. cit.) and Art. 5(2) of Decision No. 406/2009/EC (European Parliament and Council of the European Union, 2009(b), op. cit.).

the particular economic circumstances in two emerging economies and their initiatives to tackle increasing GHG emissions.

4.3.1 The untapped potential in emerging economies

Experience suggests that primary energy use in developing countries can be cut by 30-50% because the cost of energy savings is negligible compared with the cost of increasing energy supply (Fujiwara and Egenhofer 2008). While energy intensity started declining mostly as a result of structural changes in emerging economies (and to an extent in economies in transition), much of the technical potential across the supply, transmission and use of energy is still to be tapped. Even so, major challenges remain. Without changes in policy frameworks and appropriate instruments to facilitate investment in new technologies, emerging economies are likely to follow a carbon-intensive development path. In most emerging economies, there are strong pressures for the quick expansion of energy supply, notably for power generation and transport fuels, with little short-term emphasis on substituting fossil fuels. Technological cooperation combined with capacity building can help in the important area of fuel-switching. Most probably, such efforts will necessitate substantial financial transfers from developed to developing and emerging economies among other steps towards enhancing adaptive capacity, because given their limited domestic sources, the latter will likely continue in most cases to prioritise growth over mitigation. Furthermore, the increase of financial transfers can be seen as a first sign of developed countries' determination to fulfil their commitments under the UNFCCC to take a lead in the fight against climate change.

Fujiwara and Egenhofer (2008) call for an action-based approach, presenting a portfolio of actions that can be implemented and accelerated on a global scale, especially in the G8+5 countries and the EU. The portfolio of actions, ranging from energy and industry to transport, buildings and appliances, could become a basis on which these developed and developing countries can cooperate.

4.3.2 Mexico

Mexico will host the next annual climate-change conference in Cancún in December 2010, and be expected to potentially bridge the differences that arose among major negotiating groups at the Copenhagen conference. In support of the Copenhagen Accord, Mexico submitted its national mitigation actions with a GHG emissions reduction target. Mexico aims at reducing its GHG emissions by up to 30% from the BAU scenario by 2020, given that developed countries provide adequate financial and technological support.²¹ For the long-term (by 2050), the country aspires to reduce emissions by 50% from 2000 levels.²² This commitment is based on the strategy summarised below.

In 2009, the government adopted its Special Climate Change Program (also known as 'PECC' in Mexico), which outlines a long-term vision with medium-term goals for mitigation and adaptation actions in relevant sectors. In 2012, the full implementation of the programme will achieve a reduction in total annual emissions of 51 million tons of CO₂e from the BAU, about 8% of total emissions. From 2008 to 2012, 12 groups of measures in the programme will account for 60-70% of the GHG potential.²³ Moreover, the World Bank has developed an analysis of a low carbon-

²¹ Letter to Yvo de Boer, Executive Secretary, UNFCCC, from the Government of Mexico, 31 January 2010 (retrieved from <http://unfccc.int/home/items/5265.php>).

²² J. Martínez Fernández, "Mexico's Special Program for Climate Change (PECC)", 9 June 2009.

²³ Ibid.

development scenario for Mexico (MEDEC), targeted at key emitting sectors such as energy, energy end-use and transport. According to the MEDEC study, more than half of industrial energy use is concentrated in three sub-sectors: cement, iron and steel, and chemicals and petrochemicals. While Mexico's large-scale industries such as iron, steel and cement are among the most efficient, small and medium-sized enterprises accounting for a large part of the sector have high levels of energy intensity. The study recommends targeting energy efficiency improvements, for example in motor and steam systems or in kilns and furnaces, as well as co-generation, which may require change in the regulations on PEMEX (Mexico petroleum), a state-owned oil company (Johnson et al., 2009).

4.3.3 *China*

In support of the Copenhagen Accord, China has set several voluntary targets for domestic actions, such as reducing CO₂ emissions per unit of GDP by 40-45% from the 2005 level by 2020 and increasing the share of non-fossil fuels in primary energy consumption to around 15% by 2020.²⁴ Since the Copenhagen conference, China has started legislative work on domestic measures to achieve its commitments: amending the renewable energy law to promote wind and solar energy, increasing fines against utilities for failing to buy green energy or connect green sources to the grid and making a move towards incorporating the carbon intensity commitment into the next five-year plan.²⁵

China's strategy to address energy and climate change has been outlined in its National Climate Change Programme published in June 2007 and the strategy has been internationally presented in a subsequent White Paper published in October 2008 (State Council of the People's Republic of China, 2008). According to the 2009 progress report (National Development and Reform Commission, People's Republic of China, 2009), the energy consumption per unit of GDP (energy intensity) has continued to fall, helped by a decline in energy intensity of the major energy-intensive industries (e.g. power supply, steel, chemicals, cement and aluminium) since 2005. China has harvested some of the lowest hanging fruit in its early actions for energy efficiency improvements as follows.

The Top 1,000 Enterprises Programme was established in 2006. The programme sets a significant portion of the overall 20% energy-intensity target on China's 1,000 largest state-owned enterprises, mostly in heavy industry, which accounted in 2005 for at least a third of the country's total, primary energy demand and 47% of industrial energy demand (Seligsohn et al., 2009a). The programme contributed to two-thirds of the country's energy efficiency gains in 2006 and half of the gains in 2007 (Price et al., 2008, as quoted in Seligsohn et al., 2009b).

The government also started a programme for the large-scale closure of many inefficient, small industrial plants. In 2008, China closed 16.3GW worth of small thermo-power generating units in 325 power plants, and plants with capacities for 53 million tons of cement production, 6 million tons of steel production and 14 million tons of iron production (National Development and Reform Commission, People's Republic of China, 2009).

From 2008, the government required all new coal-fire power plants built in China to use state-of-the-art, commercially available technology. Consequently, the majority of the world's most

²⁴ Letter to Lars Lokke Rasmussen, Prime Minister of Denmark, signed by Wen Jiabao, Premier of the State Council of the People's Republic of China, 29 January 2010; letter to Ban Ki-moon, Secretary-General of the United Nations, signed by Wen Jiabao, Premier of the State Council of the People's Republic of China, 29 January 2010 (retrieved from <http://unfccc.int/home/items/5265.php>).

²⁵ Ibid.

efficient, coal-fired power plants are built in China (Nalbandian, 2008 as quoted in Seligsohn et al., 2009a).

Finally, out of the top ten energy conservation projects, six have been developed in the industrial sector: the retrofit of coal-fired industrial furnaces (kilns), district co-generation, waste heat and residual pressure utilisation, petroleum conservation and substitution, electrical motor system energy conservation, and energy system optimisation (National Development and Reform Commission, People's Republic of China, 2009; Teng et al., 2009).

The above measures are only a few among many actions for mitigation and adaptation in China, selected for their explicit focus on energy efficiency improvements in industrial sectors. In the future, increasing attention will likely be paid not only to implementation but also to the measurement, reporting and verification of domestic mitigation actions in China.

4.4 Sectoral dimensions of US climate policy

In association with the Copenhagen Accord, the US reiterated its pledge of GHG emissions reduction in the range of 17% below 2005 levels on the condition of support from Congress on anticipated energy and climate legislation, which would set a pathway for a 30% reduction in 2025, a 42% reduction in 2030 and an 83% reduction by 2050.²⁶ This legislation, including the reduction timetable, refers to a forthcoming Senate bill that would mirror the American Clean Energy and Security Act (ACESA) passed by the House of Representatives. The following sections look at some examples of enacted legislation and current initiatives, and gives an overview of the ACESA and the Clean Energy Jobs and American Power Act (CEJAPA) approved by the Senate Committee on Environment and Public Works (EPW) at the federal level and that of the Regional Greenhouse Gas Initiative (RGGI) at the state level.

4.4.1 Federal cap-and-trade proposals

To date the most important pieces of legislation that enables the creation of a federal cap-and-trade scheme are the US ACESA in the House of Representatives and a mirrored act, the CEJAPA in the Senate. Additional proposals have been introduced in the Senate: for example, the Carbon Limits and Energy for America's Renewal Act (S.2877, Cantwell–Collins) and the “framework for climate action and energy independence” (Kerry–Lieberman–Graham),²⁷ both introduced in December 2009 (Larsen, 2009)²⁸. Since the two last proposals are presently under consideration, this section only refers to the two passed acts.

²⁶ See the UNFCCC web page, “Appendix I: Quantified economy-wide emissions targets for 2020” <http://unfccc.int/home/items/5264.php>

²⁷ Letter to President Barack Obama, signed by J. Kerry, J.I. Lieberman, L.O. Graham, 10 December 2009 (retrieved from http://kerry.senate.gov/newsroom/pdf/Climate_Framework.pdf). It was reported that despite bipartisan preparation work for months, the only Republican senator, L.O. Graham, pulled out two days before the date planned for the release of the bill (26 April 2010), and its introduction has been postponed (see e.g. <http://www.nytimes.com/cwire/2010/04/26/26climatewire-kerry-lieberman-scramble-to-avoid-climate-bi-14420.html>).

²⁸ See also “Climate actions in congress”, Pew Center on Global Climate Change (retrieved from www.pewclimate.org).

The American Clean Energy and Security Act (ACESA, H.R. 2454, Waxman–Markey Bill)²⁹

In June 2009, the US House of Representatives passed the Waxman–Markey Bill by a close vote (219 to 212). The act passed, ACESA, contains five titles but the following summary concentrates on Title III and Title V, to give an overview of the proposed cap-and-trade programme mainly focusing on GHG emissions.

Coverage: The programme covers seven GHGs.³⁰ Hydrofluorocarbons (HFCs) are subject to a separate cap. The sources covered include all power plants and large stationary sources emitting more than 25,000 tonnes of GHGs per year. The programme applies to both upstream emissions (e.g. petroleum refiners or importers) and downstream ones (e.g. industrial plants and natural gas distributors). The GHG cap will expand the coverage in three phases from 2012 through 2016, up to nearly 85% of US GHG emissions.

Caps: The programme sets two caps, a mandatory cap on emissions from the installations covered and non-binding, economy-wide, emission reduction goals for all sources.

Emission caps are 3% below 2005 levels in 2012, 17% below 2005 levels in 2020, 42% below 2005 levels in 2030 and 83% below 2005 levels in 2050.

Economy-wide emission reduction goals are the same as the emission caps except the 2020 target being 20% below 2005 levels.

Allocation: The majority of allowances are to be distributed for public benefits including consumer benefits. Low- and moderate-income households will also receive a tax credit or rebate. Auctions will start in March 2011. Initially, about 20% of allowances will be auctioned. The share of auctioning will increase over time to about 70% by 2030 and beyond. There will be a strategic allowance reserve for auction. The initial minimum price for 2012 will be \$28 and the price for 2013–14 will be the 2012 price increased by 5% plus the inflation rate. From 2015, the minimum reserve price will be 60% above the three-year rolling average of the market price. No more than 20% of the compliance obligation may be annually purchased from the strategic reserve.

Timing: The compliance period is two years with unlimited banking. Borrowing from the next year is unlimited and with no interest, but borrowing from the second to fifth years is limited up to 15% of the compliance obligation and at 8% annual interest.

Offsets: The programme allows up to 2 billion tonnes of offsets to be used for compliance: 1 billion from domestic projects (forestry and agriculture overseen by the Department of Agriculture) and 1 billion from international programmes or projects. If the domestic supply is not sufficient, the Environmental Protection Agency can raise the use of international offsets up to 1.5 billion. From 2018 there will be discount for international offsets: 1.25 offset credits for each tonne of emissions. There will be no discount for domestic offsets. The programme approves the issuance of offset credits based on sectoral crediting mechanisms targeted at sectors in eligible countries. Credits may also be issued in exchange for credits issued by other programmes (e.g. the CDM) that create equal or greater assurance of the environmental integrity of the US programme.

²⁹ The summary of this bill is based on the following sources: “Waxman–Markey short summary”, Pew Center on Global Climate Change, 26 June 2009 (retrieved from www.pewclimate.org) and Larsen et al. (2009a).

³⁰ The seven gases are CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).

Cost containments: Sectors are presumed to be eligible for rebates if they meet i) a 5% energy or GHG-intensity threshold and a 15% trade intensity or ii) a 20% energy or GHG-intensity threshold. Each sector is rebated at 100% of the direct and indirect emissions cost on average. Rebates will be phased out from 2025 in principle. If no international agreement is reached before January 2018 to address competitiveness concerns, the president will establish an international reserve allowance programme to adjust the price of energy-intensive imports at the border.

The Clean Energy Jobs and American Power Act (CEJAPA, S.1733, Kerry-Boxer)³¹

The Senate Committee on EPW passed the CEJAPA in November 2009. The final bill draws heavily from ACESA (Waxman–Markey Bill), for example, in setting a cap-and-trade scheme, but differs in several aspects such as the 2020 target. While the ACESA is comprehensive and encompasses clean energy and climate change, this bill mainly focuses on GHG emission reductions. The following summary concentrates on provisions concerning the cap-and-trade scheme, mainly focusing on GHG emissions.

Coverage: The programme covers the same seven GHGs covered in the ACESA. HFCs are subject to a separate cap. Perfluorocarbons (PFCs) may be also regulated separately under performance standards. The sources covered include power plants and large stationary sources with annual GHG emissions over 25,000 tonnes. The programme applies to both upstream and downstream emissions. The cap will expand the coverage in several phases over a five-year period. By 2016, almost 85% of national GHG emissions will have been covered under the cap.

Caps: The programme sets two caps: a mandatory cap on emissions from the installations covered and non-binding, economy-wide, emission reduction goals for all sources.

The 2020 emissions cap is more stringent than that under the ACESA, i.e. a 20% cut from 2005 levels in 2020. Other emission caps are the same as those in the ACESA: 3% below 2005 levels, 42% below 2005 levels in 2030 and 83% below 2005 levels in 2050. Economy-wide goals are same as those in the ACESA.

Allocation: Consumer benefits are taken into account in allocation. Auctions will start in March 2011. There will be a market stability reserve for auction. The minimum reserve price for 2012 will be \$28 per tonne in 2005 dollars and increase by 5% from 2013 through 2017 and by 7% thereafter plus the inflation rate on top of the previous year's reserve price.

Timing: The compliance period is two years with unlimited banking and limited borrowing.

Offsets: The total limit on offset use is the same as that in the ACESA but the division between the domestic and international offsets differs. The programme allows use of 2 billion tonnes of qualified offsets per year, with 1.5 billion from domestic projects (forestry and agriculture overseen by the Department of Agriculture) and 0.5 billion from international projects or programmes. If domestic supply is not sufficient, the use of international offsets can be increased up to 1.25 billion. Like the ACESA, this programme will set a discount for international offsets: after 2018, 1.25 international offsets for each tonne of emissions. The programme also allows the use of offset credits based on sectoral crediting mechanisms in eligible countries and the issuance of credits in exchange for credits issued by other programmes (e.g. the CDM) that give equal or greater assurance of the environmental integrity of the US programme.

Cost containments: Sectors are presumed to be eligible for rebates under the same conditions as described in the ACESA. Each sector is rebated at 100% of the average direct and indirect

³¹ This section is based on the following sources: “Summary of the Clean Energy Jobs and American Power Act (S.1733) as passed by the EPW Committee”, Pew Center on Global Climate Change, November 2009 (retrieved from www.pewclimate.org) and Larsen et al. (2009b).

emissions cost. Rebates will be phased out from 2025 in principle. A placeholder section opens the possibility for including border measures to complement the rebate provisions.

Lastly, it is worth mentioning in relation to the next section that the CEJAPA temporarily prohibits states from running their own cap-and-trade programmes until 2017.

4.4.2 Regional Greenhouse Gas Initiative³²

The RGGI is the first mandatory cap-and-trade programme for GHG emissions in the US to limit or ‘cap’ CO₂ emissions from large electricity-generating installations fired by fossil fuels. RGGI entered into effect and started regulating CO₂ emissions on 1 January 2009. A series of auctions for emission allowances has taken place since September 2008.

Coverage: The programme covers CO₂ emissions from electricity-generating installations fired by fossil fuels of at least 25 MW that burn more than 50% fossil fuel (approximately 225 facilities region-wide). The power-generating installations covered account for about 28% of CO₂ emissions in a region consisting of 10 north-eastern and mid-Atlantic states³³ in the US.

Cap: The cap aims at stabilising emissions from 2009 through 2014 to the level roughly equal to historical emissions. From 2015 to 2018, the cap on emissions will decline by 2.5% per year over the next four years, thus in 2018 reaching a level that is 10% lower than the baseline.

Allocation: Each state’s programme determines its share of the regional cap, 188 Mt for the 10 states. Each state then issues allowances in a number equivalent to its share of the regional cap. States have agreed to allocate at least 25% of the allowance for consumer benefits or strategic energy purposes (e.g. renewable energy and energy efficiency). They may choose how to allocate the remaining 75% of their allowances. Yet the trend shows that states distribute allowances primarily through auctions. Initially, over 85% of the region’s allowances are expected to be auctioned in the early stages of the programme. Eventually, the auctioned share is expected to rise to over 90%.

Timing: The compliance period is three years, starting with the first period of 2009–11. The programme allows unlimited banking.

Offsets: A power plant is allowed to use offsets to meet up to 50% of emission reductions from BAU projections, equivalent to 3.3% of its compliance obligations. If allowance prices rise above thresholds, more offsets may be allowed (see below).

Cost containment: There are two safety valve (or price trigger) provisions. If the ‘stage-one price trigger’ is reached (i.e. the allowance price rises above \$7/short tonne on average), the use of offsets increases by up to 5% of the facility compliance obligation. If the ‘stage-two price trigger’ is reached (i.e. the allowance price rises above \$10/short tonne on average),³⁴ the

³² This section is based on the following sources: RGGI Fact Sheet, “Regional Greenhouse Gas Initiative”, 22 April 2009 (retrieved from www.rggi.org); “Overview of RGGI CO₂ Budget Trading Programme”, October 2007 (retrieved from www.rggi.org); WRI Fact Sheet, “Regional cap-and-trade programs”, World Resources Institute, July 2009 (retrieved from www.wri.org); WRI and Pew Center on Global Climate Change, “Overview of Regional Initiative’s offset programs” (retrieved from www.wri.org); “Q&A: Regional greenhouse gas initiative”, Pew Center on Global Climate Change (retrieved from www.pewclimate.org).

³³ The states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

³⁴ The price trigger is reached if the 12-month rolling average CO₂ allowance price reaches or exceeds the trigger price. The trigger price is set in 2005 dollars and will be adjusted each year according to the

compliance period will be extended by one year, to maximum of four years and use of offsets will increase by up to 10% of the facility compliance obligation. Under the stage-two price trigger, the programme will also approve the use of international credits, such as those generated from the CDM.

5. How to strengthen the effectiveness of sectoral approaches?

There would be more than one way to improve the effectiveness of sectoral approaches. This section examines difficulties with the choice of performance metrics, reporting, and compliance, drawing some examples from existing systems such as the UNFCCC, the Kyoto Protocol and the EU.

5.1 Choice of performance metrics³⁵

There is a recommendation to include as many performance components as possible, thus balancing between them i) fuel use, electricity use and GHG emissions; ii) relative (intensity) and absolute bases; and iii) on-site and off-site fuel use and GHG emissions (Newman, 2009). This task could be done by using a composite index system based on the Solomon index, spanning a number of performance components.

Considering the complexity in data availability and measurability, there is a suggestion for a simpler way to use such composite indices to operationalise benchmarking in negotiations. The target level for these reference intensities may be arbitrarily decided like a ‘yardstick’. An index for comparison may be useful in certain sectors with a large number of measurement needs. For example, in the steel sector seven parts of the process require measuring, which may be too many for effective negotiations. Detailed benchmarks could still make sense in homogenous industries or in sectors like cement and aluminium, which appear to require a smaller number of measurements.

Therefore, a rough framework, possibly taking the index approach and based on what would be possible to measure, could be negotiated. In addition, different performance indicators may be used for different countries as a basis for measurable commitment. As seen in the list of pledges of national commitments associated with the Copenhagen Accord, various national circumstances usually result in diverse preferences in the choice of benchmarking performance metrics, i.e. indicators and standards.

5.2 Reporting

Among the three stages of measurement, reporting and verification, international cooperation and coordination are most developed in the area of reporting. This section introduces both the UNFCCC requirements and other protocols for measuring and reporting progress.

consumer price index for the stage-one trigger price or the price index plus 2% for the stage-two trigger price.

³⁵ This section is primarily based on the results of the “Technical workshop on sectoral approaches: Benchmarking, sector boundary and monitoring, reporting & verification issues”, Brussels, 17-18 September 2008, carried out in the context of the study on *Global sectoral approaches as part of the post-2012 framework*, supported by the European Commission, DG Enterprise and Industry.

5.2.1 UNFCCC reporting requirements

The core data around which UNFCCC negotiations revolve are provided in the GHG inventories. These are provided by means of national communications and reports submitted to the UNFCCC Secretariat in accordance with Arts. 4 and 12 of the Convention.

The reporting requirements differ for Annex I and non-Annex I parties. The UNFCCC reporting guidelines on Annex I inventories³⁶ provide the requirements for developed countries, while the guidelines for the preparation of national communications for non-Annex I parties³⁷ address the developing countries' requirements.³⁸

For Annex I countries, the inventory data are provided in annual GHG inventory submissions, which are then reviewed in-depth by international teams of independent experts, typically by means of in-country visits. A review report is then provided annually for each party.

For Non-Annex I parties, the inventory data are provided in the national communications under the Convention. Non-Annex I parties are not required to submit an annual GHG inventory, and the national communications are not subject to in-depth reviews. The national communications contain information about most of the covered gases by sector. The level of compliance has in general been satisfactory, but comparability is thwarted by a change in the UNFCCC guidelines: while current guidelines require Non-Annex I countries to estimate GHG inventories for the year 2000, many reports present data for other years, based on previous guidelines. A number of Non-Annex I countries, in particular LDC parties, still face reporting difficulties because of a lack of resources.³⁹

To manage the data obtained through reporting and render it accessible to the public, the Secretariat has created the Greenhouse Gas Information System.⁴⁰ The data is presented in various breakdowns (by sector, gas and year).

5.2.2 Progress in measurement and reporting protocols

In the cement sector, significant progress has been made towards common, new benchmarking methodologies. Companies under the CSI have agreed on a cement CO₂ protocol as a harmonised methodology for calculating and reporting their emissions (CSI, 2005). All the direct sources and major indirect sources of CO₂ emissions related to the manufacturing process are covered in absolute as well as specific or unit-based terms. Since its creation in 2001, the protocol has been updated (in 2005) based on the extensive experience of companies worldwide in applying it. It has been aligned closely with the World Resources Institute (WRI)/WBCSD GHG Protocol encompassing all types of sectors, which was published in 2001 and updated in 2004.⁴¹ Moreover, the CSI, together with Ecofys, has developed a sectoral benchmarking CDM methodology to be

³⁶ See United Nations, FCCC/SBSTA/2004/8.

³⁷ See United Nations, Decision 17/CP.8.

³⁸ See the UNFCCC web page, "GHG data from UNFCCC"
http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php

³⁹ UNFCCC, Fact Sheet, "UNFCCC emissions reporting", June 2009, www.unfccc.int.

⁴⁰ See the UNFCCC web page, "Greenhouse gas inventory data"

http://unfccc.int/ghg_data/items/3800.php

⁴¹ "The GHG protocol: A corporate accounting and reporting standard", retrieved from the Greenhouse Gas Protocol website, <http://www.ghgprotocol.org>

used for plant performance derived from its global cement database on CO₂ and energy information, “Getting the Numbers Right (GNR)”.⁴²

In addition, a Benchmarking and Energy Saving Tool (BEST)⁴³ for the cement industry in China has been developed by the Lawrence Berkeley National Laboratory with collaborating institutes. It takes into account only the energy performance of cement production. Using this tool for self-assessment, the plants are able to benchmark their energy use against best practice levels and evaluate energy efficiency measures.

Ecofys has also created sector proposal templates for developing national crediting baselines under sectoral crediting with SNLTs in the power generation, cement and transport sectors.⁴⁴ Although the baseline does not have to result from benchmarking, collecting detailed and transparent data is essential. Thus, the templates can be used as a capacity-building tool in developing countries for addressing such data and measurement issues.⁴⁵

Apart from the WRI/WBCSD GHG Protocol and the Cement CO₂ Protocol, existing measurement protocols include the EU ETS monitoring and reporting guidelines.⁴⁶ Also, the International Petroleum Industry Environmental Conservation Association (IPIECA), together with the American Petroleum Institute and the International Association of Oil & Gas Producers, has developed Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions (IPIECA, 2003). This method for reporting GHG emissions can be used by oil and gas companies from any part of the world, but there is no indication of whether they are suitable for sectoral benchmarking and measurement, reporting and verification. Progress on common protocols in other energy-intensive sectors, especially iron and steel, has been slower owing to the boundary-setting and other measurement complexities described above.

Measurability is essential for making sectoral approaches operational as part of a future international, climate policy framework and is likely to require a common scientific scale of measurement, including performance indicators and boundaries. The Japanese government has foreseen several steps.⁴⁷ First, the UNFCCC process could involve the participation of public and private industrial experts, especially from the existing industry initiatives and associations (worldsteel, IAI, CSI, etc.). Next, the International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) process of developing common standards could authorise the UN process. Finally, the ISO/IEC could simultaneously collaborate with international organisations such as the IEA, which has already developed energy efficiency indicators. It would be useful to base these steps on the ongoing collaboration between the

⁴² See the WBCSD-CSI’s webpage, “Sectoral CDM Benchmarking Methodology”, http://www.wbcscement.org/index.php?option=com_content&task=view&id=59&Itemid=120

⁴³ See the Lawrence Berkeley National Laboratory’s webpage, “Benchmarking”, <http://industrial-energy.lbl.gov/node/100>

⁴⁴ For further information, see the Sectoral Proposal Templates website, www.sectoral.org.

⁴⁵ See M. Jung et al., “Sector proposal templates – Overview and lessons learnt”, presentation at the “Technical workshop on sectoral approaches: Benchmarking, sector boundary and monitoring, reporting & verification issues”, Brussels, 17 September 2008; on capacity building, see also Fujiwara et al. (2010).

⁴⁶ Commission Decision 2007/589/EC of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, *Official Journal of the European Union*, L229/1-85, 31 August 2007. For amendments adopted to the Decision in 2008-09 see http://ec.europa.eu/environment/climat/emission/mrg_en.htm

⁴⁷ See J. Arima, “Sectoral Approaches: Applications and Challenges”, presentation at the “Technical workshop on sectoral approaches: Benchmarking, sector boundary and monitoring, reporting & verification issues”, Brussels, 17 and 18 September 2008; see also H. Fujisawa, “Key issues to operationalise SA”, presentation at the “Technical workshop on sectoral approaches: Benchmarking, sector boundary and monitoring, reporting & verification issues”, Brussels, 17 and 18 September 2008.

WBCSD and the WRI with the ISO on joint promotion of the WRI/WBCSD GHG Protocol standards and the ISO 14064 standard for GHG accounting and reporting (WBCSD, 2007).

5.3 A compliance system for sectoral approaches

One possible way to enhance the effectiveness of sectoral approaches would be to have an embedded compliance system. This section first illustrates how the compliance system of the Kyoto Protocol works, and then turns to that of the EU ETS. A significantly weaker arrangement for compliance with the agreement on non-ETS sectors is also introduced.

5.3.1 Compliance system of the Kyoto Protocol

The issue of compliance is central to international agreements, and has proved a challenge in particular for international environmental law. The Kyoto Protocol contains a compliance mechanism (Art. 18) to ensure that parties meet their commitments. Specific procedures and mechanisms were introduced in the first meeting after the entry into force of the Protocol.⁴⁸ Under this framework the Compliance Committee has been operational since March 2006. Its backbone is composed of two branches, the ‘facilitative branch’ and the ‘enforcement branch’. This structure is the first of its kind, and allows for both preventive and reactive actions. The facilitative branch provides technical and financial advice to parties facing difficulties in meeting their commitments. The enforcement branch is responsible for ensuring that the parties comply with their commitments. The compliance tools range from i) ‘declarations of non-compliance’, aimed at applying moral pressure through a reputation effect; ii) the request to the party concerned to present a plan analysing the causes on non-compliance and indicating the corrective measures; and finally iii) the possibility to suspend eligibility for participation in the flexible mechanisms. The latter sanction depends heavily on the good functioning and the attractiveness of the market mechanisms, whereby exclusion might mean substantial disadvantages.

A case of non-compliance with emission targets cannot come before the enforcement branch until after the end of the commitment period in 2012. Up to now, the compliance cases that have been eligible to be brought before the enforcement branch have been limited to matters of procedure or implementation (e.g. registry and reporting issues). To date there have been four cases – against Greece, Canada, Croatia and Bulgaria. Greece and Bulgaria’s cases focus on the national system, including arrangements for estimating emissions and sinks covered by the Protocol and for reporting and archiving this information. Canada’s case relates to the national registry. Croatia’s case is concerned with the assigned amount and the commitment period. In conclusion, Greece and Canada were found in non-compliance on the final decision and on the preliminary decision respectively, but as they remedied the situation, the cases were subsequently closed. Croatia expressed disappointment with the final decision of non-compliance. Bulgaria’s case has been opened but the country has not yet been found in non-compliance.⁴⁹

A major drawback to the mechanism, however, is that the enforcement branch cannot operate in a binding fashion. Any procedures and mechanisms entailing binding consequences (Art. 18, Kyoto Protocol) will require the adoption of an amendment. Agreement on such an amendment has not been reached so far and has met with strong opposition. As a result, the compliance mechanism is presently weakened by the fact that it is not binding. While the compliance procedure allows consideration of sanctions, the ‘facilitation’ aspect will significantly override the ‘enforcement’ aspect (Maljean-Dubois, 2007) unless an amendment is adopted.

⁴⁸ See Decision 27/CMP.1.

⁴⁹ See the UNFCCC web page, “The compliance under the Kyoto Protocol” http://unfccc.int/kyoto_protocol/compliance/items/2875.php

5.3.2 *A compliance system for sectoral approaches: An example of the EU*

An example of a functioning compliance system can be found in the EU ETS. The EU scheme has a robust compliance system from an institutional perspective. Art. 16 of the EU ETS Directive describes procedures for consequences in the case of non-compliance, i.e. penalties. The penalty started with €40/tCO₂-e in the first phase (2005–07) but amounts to €100/tCO₂-e in the second phase (2008–12). The non-compliance penalty will further increase from €100/tCO₂-e in the third phase (2013–20) in accordance with the European Index of Consumer Prices (i.e. the inflation rate) to maintain a deterrent effect.⁵⁰ Moreover, payment of the penalty will not release the operator from the obligation to surrender in the following year an amount of allowances equal to the excess emissions.

While installations in the ETS sector (i.e. the electricity and industry sectors) are subject to a relatively strong compliance system, member states will not be held liable for breaching their individual targets limiting GHG emissions from non-ETS sectors. Under Art. 7 on “corrective action” of Decision 406/2009/EC, member states will have to compensate for underperformance in the following year. For this purpose, the excess emissions will be multiplied by a mandatory climate ‘abatement factor’ of 1.08, reducing emission allowances for the following year.⁵¹

6. Sectoral approaches as part of the post-2012 framework

A reference to sectoral approaches in the Bali Action Plan means that there is a chance for them to become part of the post-2012 framework. They could be linked to other priority issues, such as further commitments by developed countries, NAMAs by developing countries, financing and technology. This section first discusses the shape of the post-2012 architecture and then how sectoral approaches can fit into the post-2012 framework.

6.1 Decentralisation and flexibility in the post-2012 architecture

Although it is difficult to speculate much on the prospects of reaching a post-2012 agreement, some preliminary thinking has developed over how the future framework might look. It is suggested that the post-2012 architecture will likely have a more decentralised and flexible architecture than its predecessor. It would entail less rigidity in the overall architecture, reflecting a shift in the economic capabilities of parties, increasing mobility among groups of countries on the ladder of making strong commitments and enlarging a portfolio of instruments to meet commitments – including innovative tools of tradable units to enable a variety of actions contributing to the GHG emission reductions to be counted (Fujiwara, 2008). It is even argued that a pledge-and-review model for supporting technology, finance and capacity building could fit into the decentralised approach favoured by the Bali Action Plan (Doornbosch and Knight, 2008). Such decentralised approaches (which we call ‘bottom-up’) would rely greatly on the correct conduct of measurement, reporting and verification of mitigation actions in developing countries to ensure that the resources provided by developed countries are spent effectively. Clear targets and timetables are needed. Measurement, reporting and verification are required for NAMAs by developing countries in accordance with the Bali Action Plan.

⁵⁰ See Directive 2009/29/EC, European Parliament and Council of the European Union, 2009(a), op. cit.

⁵¹ See Decision No. 406/2009/EC, European Parliament and Council of the European Union, 2009(b), op. cit.

6.2 How can sectoral approaches fit into the post-2012 framework?

There is a set of questions about fitting sectoral approaches into the negotiation strategy and the post-2012 framework per se. The starting point is how sectoral approaches can be applied to the targets-and-timetables approach used under the Kyoto Protocol. Sectoral approaches could work together with the targets-and-timetables approach or with a pledge-and-review model. Otherwise, an action-based strategy, which covers sectoral approaches, can be regarded as a way of integrating targets and timetables, as they are agreed, with consistent and comparable policies and measures (Fujiwara and Egenhofer, 2008). Section 3 above introduced bottom-up, developing country commitments with an option of SNLTs (Ward et al., 2008; Schmidt et al., 2006). Transition from sectoral crediting to sectoral trading could act as a stepping-stone on the evolution path towards a flexible mechanism, moving from the current CDM towards a cap-and-trade scheme with binding absolute reductions. They could exist side by side with other tools on different stages of the evolution path. Since the UNFCCC is a framework agreement with a longer time horizon as well as a wider coverage of participating countries, its scope allows a broader range of issues, including mitigation tools, under a single umbrella. Hence, sectoral approaches could have a better chance of developing into part of the post-2012 framework under the UNFCCC than under the Kyoto Protocol. Section 4.1 illustrated the state of play in UN discussions, chiefly under the AWG-LCA track.

As section 5 outlined, there will be a hybrid range of agreements and mechanisms to make sectoral approaches operational.⁵² The simplest option is to have only intergovernmental agreements such as a reporting protocol, as an extension of the UNFCCC requirements. Other measurement and reporting protocols could be recorded in a UN registry but remain optional for parties to adopt. The other option is to have both intergovernmental agreements and agreements negotiated between the government and industry in each entity. The former provides the government with guidelines for formulating the latter. Lessons have been learned from the EU's experience in implementing the EU ETS, especially in formulating national allocation plans along the EU monitoring and reporting guidelines in the first two phases (2005–07 and 2008–12). Moreover, intergovernmental agreements would not only provide for guidelines for domestic legislation and regulations but also set up international mechanisms to reduce the unevenness of distributional impacts or increase access for those with less resources to implement policies and measures, e.g. mechanisms for facilitating access to finance or technology. The EU ETS will create mechanisms for the distribution of allowances to be auctioned by member states: one is to increase the share of allowances of 19 member states (see appendix 2) and another is to count the early efforts of 9 member states in their share of allowances (see appendix 3). This combination would make the implementation of domestic measures more enforceable. Nevertheless, regardless of the variation, any new system would not exempt parties from existing commitments to the UNFCCC, including national communications.

7. Concluding remarks

Research shows that sectoral approaches could contribute to the development of a method that could optimally set a cap on GHG emissions and allocate emission allowances, especially (but not exclusively) through benchmarking. Sectoral benchmarking could be built upon improvements in boundary setting and data collection, along with best practices. The importance of this method is common to all three models – industry-led transnational initiatives, bottom-up developing country commitments and sectoral crediting. Yet, views over the costs associated with and capacities for sectoral benchmarking differ from country to country, especially between developed countries

⁵² One of the mechanisms could be a consultative body. See e.g. Fujiwara (2010).

and emerging economies or developing countries that are economically more advanced. Even if sectoral approaches form part of a post-2012 agreement, an agreed outcome will likely cover some basic principles for benchmarking and frameworks for further discussions on the technical details.

List of Acronyms

ACESA	American Clean Energy and Security Act (US)
APP	Asia–Pacific Partnership on Clean Development and Climate
AWG-LCA	Ad-hoc Working Group on Long-term Cooperative Action under the Convention/UNFCCC
BAU	Business as usual
CDM	Clean Development Mechanism: A mechanism under Art. 12 of the Kyoto Protocol
CEJAPA	Clean Energy Jobs and American Power Act (US)
CER/ERU	Certified Emission Reduction/ Emission Reduction Unit
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
CO ₂	Carbon dioxide
CSI	Cement Sustainability Initiative (under the auspices of the World Business Council for Sustainable Development)
EPW	Environment and Public Works (US Senate Committee)
ETS	Emissions Trading Scheme (or System)
EU	European Union
EU ETS	EU Emissions Trading Scheme
G8	Group of Eight (a forum of the heads of governments of seven large developed countries economies and Russia)
G8+5	Group of Eight plus the heads of government of the five leading emerging economies
GDP	Gross domestic product
GHGs	Greenhouse gases; the six gases covered by the Kyoto Protocol (CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆)
GW	Gigawatt
HFCs	Hydrofluorocarbons
IAI	International Aluminium Institute
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Organisation for Standardisation
KP	Kyoto Protocol
kWh	Kilowatt hour

LDCs	Least-developed countries
MEDEC	A low carbon-development scenario analysis in Mexico (World Bank)
Mt	Million metric tonnes
MW	Megawatt
NAMAs	Nationally appropriate mitigation actions
NDRC	National Development and Reform Commission (China)
OECD	Organisation for Economic Cooperation and Development
PECC	Programa Especial de Cambio Climático (Mexico's Special Programme on Climate Change)
PEMEX	Petróleos Mexicanos (Mexican Petroleum)
PFC	Perfluorocarbon
RGGI	Regional Greenhouse Gas Initiative
SA	Sectoral approaches
SNLTs	Sector no-lose targets
tCO ₂ e	Metric tonnes of carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

References

- Aasrud, A., R. Baron, B. Buchner and K. McCall (2009), *Sectoral market mechanisms: Issues for negotiation and domestic implementation*, OECD/IEA, Paris, October.
- Amatayakul, W., G. Berndes and J. Fenhann (2008), *Electricity sector no-lose targets in developing countries for post-2012: Assessment of emissions reduction and reduction credits*, Working Paper No. 6, CD4CDM, December 2008.
- Baron, R., B. Buchner and J. Ellis (2009), *Sectoral approaches and the carbon market*, OECD/IEA, Paris, June.
- Bodansky, D. (2007), '*International sectoral agreement in a post-2012 climate framework*', Working Paper, prepared for the Pew Center on Global Climate Change, Arlington, VA.
- Cement Sustainability Initiative (CSI) (2005), *The Cement CO₂ Protocol: CO₂ Accounting and Reporting Standard for the Cement Industry, guidance document*, WBCSD, Geneva, June (retrieved from www.wbcsd.org).
- Doornbosch, R. and E. Knight (2008), *What role for public finance in international climate change mitigation*, Discussion Paper, OECD.
- Egenhofer, C. and N. Fujiwara (2008a), *The potential of sectoral industry approaches to design a "fair" commitment*, Paper prepared for Environmental Studies Group, Economic and Social Research Institute, Cabinet Office, Government of Japan, CEPS, Brussels, March.
- (2008b), *Global sectoral industry approaches to address climate change: The way forward*, CEPS Task Force Report, CEPS, Brussels, April.
- European Commission (2005), Communication from the Commission, Further guidance on allocation plans for the 2008 to 2012 trading period of the EU Emissions Trading Scheme, COM(2005) 703 final, 22 December.
- (2007), Commission Decision 2007/589/EC of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, *Official Journal of the European Union*, L229/1-85, 31 August.
- (2009a), Communication, Towards a comprehensive climate change agreement in Copenhagen, COM(2009) 39 final, Brussels, January.
- (2009b), Communication on Stepping up international climate finance: A European blueprint for the Copenhagen deal, COM(2009) 475/3, Brussels.
- (2010a), Decision of 24 December 2009 determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage, *Official Journal of the European Union*, L 1/10-18, 5 January.
- (2010b), Communication on International climate policy post-Copenhagen: Acting now to reinvigorate global action on climate change, COM(2010) 86 final, Brussels, 9 March.
- European Parliament and Council of the European Union (2009a), Directive 2009/29/EC of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse

- gas emission allowance trading system of the Community, *Official Journal of the European Union*, L 140/63-87, 5 June.
- (2009b), Decision No. 406/2009/EC of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community’s greenhouse gas emission reduction commitments up to 2020, *Official Journal of the European Union*, L 140/136-148, 5 June.
- (2009c), Directive 2008/101/EC of 19 November 2008 amending Directive 2003/87/EC to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, *Official Journal of the European Union*, L 8/3, 13 January.
- Federation of Electric Power Companies of Japan (FEPC) 2007, *Green handbook peer review*, prepared for the Asia-Pacific Partnership on Clean Development and Climate, April (retrieved from http://www.fepec.or.jp/english/environment/asia-pacific/green_handbook_peer/index.html).
- Fujiwara, N. (2008), *On the way to Copenhagen via Poznan: Preliminary thinking about a post-2012 climate deal*, CEPS Policy Brief No. 179, CEPS, Brussels, November.
- (2009), *Flexible mechanisms in support of a new climate change regime: The Clean Development Mechanism and beyond*, CEPS Task Force Report, CEPS, Brussels.
- (2010), *Sectoral approaches to climate change: How can industry contribute?* CEPS Special Report, CEPS, Brussels, May.
- Fujiwara, N. and C. Egenhofer (2008), *Making the most of the G8+5 climate change process: Accelerating structural change and technology diffusion on a global scale*, Report of a CEPS Task Force, CEPS, Brussels, June.
- Fujiwara, N., C. Egenhofer, and A. Georgiev (2010), *Getting started now: Capacity building for the data system foundations of sectoral approaches*, CEPS Special Report, CEPS, Brussels, April.
- International Aluminium Institute (IAI)(2009), “Aluminum for future generations sustainability update 2009” (retrieved from <http://www.world-aluminium.org>).
- International Emissions Trading Association (IETA) (2010), *Thinking through the decision possibilities for a sectoral crediting mechanism: Three options to encourage discussion*, version 1, IETA, Geneva, 5 March.
- International Energy Agency (IEA)(2008), *Worldwide trends in energy use and efficiency: Key insights from IEA indicator analysis*, in support of the G8 Plan of Action.
- International Petroleum Industry Environmental Conservation Association (IPIECA) (2003), *Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions*, IPIECA, London, December (retrieved from www.ipieca.org).
- Johnson, T.M., C. Alatorre, Z. Romo, and F. Liu (2009), *Low-carbon development for Mexico*, World Bank, Washington, D.C.
- Larsen, J. (2009), *Emission reductions under cap-and-trade proposals in the 111th Congress*, World Resources Institute, Washington, D.C., 17 December (retrieved from www.wri.org).
- Larsen, J., A. Kelly and R. Heilmayr (2009a), *WRI summary of H.R. 2454, the American Clean Energy and Security Act (Waxman-Markey)*, World Resources Institute, Washington, D.C., 31 July (retrieved from www.wri.org).

- Larsen, J., A. Kelly, J. Bradbury, F. Litz and N. Bianco (2009b), *WRI Summary of S.1733, the Clean Energy Jobs and American Power Act (Kerry-Boxer)*, World Resources Institute, Washington, D.C., 30 October (retrieved from www.wri.org).
- Lawrence Berkeley National Laboratory and American Iron and Steel Institute (2007), *The state-of-the-art clean technologies (SOACT) for steelmaking handbook*, prepared for the Asia-Pacific Partnership on Clean Development and Climate, United States Department of State, and United States Department of Energy retrieved from http://www.asiapacificpartnership.org/english/pr_steel.aspx#Steel_Project_5).
- Maljean-Dubois, S. (2007), *Challenges for the international monitoring of compliance*, Synthèses, 01/2007, IDDRI, Paris (retrieved from http://www.iddri.org/Publications/Collections/Syntheses/sy_0701_maljeandubois_observanceEN.pdf).
- National Development and Reform Commission (NDRC), People's Republic of China (2009), *China's policies and actions for addressing climate change: The progress report 2009*, NDRC, Beijing.
- Newman, J. (2009), "Benchmarking – Global Sectoral Approaches as Part of a Post-2012 Framework", Background Paper prepared for the study on *Global sectoral approaches as part of the post-2012 framework*, Center for Clean Air Policy, Washington, D.C.
- Schmidt, J., N. Helme, J. Lee and M. Houdashelt (2006) *Sector-based approaches to the post-2012 climate change policy architecture*, Center for Clean Air Policy, International Future Actions Dialogue, Washington, D.C., August.
- Schneider, L. and M. Cames (2009), *A framework for a sectoral crediting mechanism in a post-2012 climate regime*, Report for the Global Wind Energy Council, Oeko Institut, Berlin, 28 May.
- Seligsohn, D., R. Heilmayr, X. Tan, and L. Weischer (2009a), *China, the United States, and the climate change*, WRI Policy Brief, World Resources Institute, Washington, D.C., October.
- Seligsohn, D., R. Bradley and J. Adams (2009b), "Energy and climate policy action in China", WRI Fact Sheet, World Resources Institute, Washington, D.C., November.
- State Council of the People's Republic of China (2008), *China's Policies and Actions for Addressing Climate Change*, White Paper, October, Beijing (retrieved from http://english.gov.cn/2008-10/29/content_1134544.htm).
- Teng, F., Y. Wang, A. Gu, R. Xu, H. McMahon and D. Seligsohn (2009), *Mitigation actions in China: Measurement, reporting and verification*, World Resources Institute Working Paper on behalf of E3G, World Resources Institute, Washington, D.C., June.
- Ward, M. (ed.), C. Streck, H. Winkler, M. Jung, M. Hagemann, N. Höhne and R. O'Sullivan (2008), *The role of sector no-lose targets in scaling up finance for climate change mitigation activities in developing countries*, Paper prepared for the International Climate Division, Department for Environment, Food and Rural Affairs (DEFRA), Climate Focus, Ecofys and GTripleC, May.
- World Business Council for Sustainable Development (WBCSD) (2007), "ISO, WRI and WBCSD Announce Cooperation on Greenhouse Gas Accounting and Verification", Press update, WBCSD, Geneva, December (retrieved from www.wbcd.org).
- (2009), *A sectoral approach: Greenhouse gas mitigation in the cement industry*, Cement Sustainability Initiative, WBCSD, Geneva, May.

Worldsteel (2009), *21st century steel: 2008-2009 update*, October

(retrieved from www.worldsteel.org/?action=publicationdetail&id=93).

Youngman, R. and A. Diamant (2010), *Sectoral and other international mechanisms designed to scale up offset supply: An overview of key issues*, Background paper for the EPRI “Greenhouse gas emissions offset policy dialogue workshop #7”, February.

Appendix 1. Member-state GHG emissions in non-ETS sectors for the period 2013–20*

Member state	Member-state GHG emission limits in 2020 compared with 2005 GHG emission levels (%)
Austria	-16
Belgium	-15
Bulgaria	20
Czech Republic	9
Cyprus	-5
Denmark	-20
Estonia	11
Finland	-16
France	-14
Germany	-14
Greece	-4
Hungary	10
Ireland	-20
Italy	-13
Latvia	17
Lithuania	15
Luxembourg	-20
Malta	5
The Netherlands	-16
Poland	14
Portugal	1
Romania	19
Slovak Republic	13
Slovenia	4
Spain	-10
Sweden	-17
UK	-16

* Adapted from Annex II of the effort sharing Decision (406/2009/EC, European Parliament and Council of the European Union, 2009(b), op.cit.).

Appendix 2. Increase in the share of allowances to be auctioned by member states *

Member state	Member-state share (%)
Austria	0
Belgium	10
Bulgaria	53
Czech Republic	31
Cyprus	20
Denmark	0
Estonia	42
Finland	0
France	0
Germany	0
Greece	17
Hungary	28
Ireland	0
Italy	2
Latvia	56
Lithuania	46
Luxembourg	10
Malta	23
The Netherlands	0
Poland	39
Portugal	16
Romania	53
Slovakia	41
Slovenia	20
Spain	13
Sweden	10
UK	0

* Adapted from the table in Annex IIa of the EU ETS Directive (2009/29/EC, European Parliament and Council of the European Union, 2009(a), op.cit.).

**Appendix 3. Distribution of allowances to be auctioned by
member states reflecting the early efforts
of some member states^{*}**

Member state	Distribution of the 2% against the Kyoto base (%)
Bulgaria	15
Czech Republic	4
Estonia	6
Hungary	5
Latvia	4
Lithuania	7
Poland	27
Romania	29
Slovakia	3

^{*} Annex IIb of the EU ETS Directive (2009/29/EC, European Parliament and Council of the European Union, 2009(a), op.cit.).