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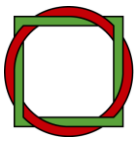

Wuppertal Institute
for Climate, Environment
and Energy

New Market Mechanisms: Prerequisites for Implementation

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Summary

The Durban conference decided to establish a new market-based mechanism that is to cover a broad segment of a country's economy. The implementation details are to be agreed at this year's conference in Qatar. The question is, however, which developing countries would actually be able to implement such a new mechanism. The introduction of the EU emission trading system highlighted the many challenges that even advanced developed countries face when establishing a carbon market. This paper therefore aims to explore the essential prerequisites for the implementation of new market mechanisms (NMM). In addition to a theoretical discussion it considers the cases of China and Mexico.

Carbon trading might either take place at the government level or be devolved to the installation level. In the first case, the following elements need to be considered: the sector and GHG coverage of the scheme; the type and stringency of the emission target; and provisions for monitoring, reporting and verification. If a scheme is broken down to the installation level, additional considerations apply: the definition and recognition of trading units; setting of installation-level targets; provisions for temporal flexibility; monitoring, reporting and verification; registry and transaction log to track trading units; market governance; and how to ensure private sector participation.

The challenges in establishing market mechanisms that cover a broad segment of the economy are formidable. Non-Annex I inventories have so far been subject to rather lenient requirements and most developing countries have serious capacity constraints. Lead times can be expected to be at least 3-5 years. The examples of Mexico and China highlight the obstacles that are faced even by more advanced developing countries. Challenges are posed in particular by monopolistic sectoral structures and MRV capacity.

Substantial capacity building activities such as the Partnership for Market Readiness are already underway. However, pinpointing requirements in detail is difficult as long as the UNFCCC has not defined detailed modalities and procedures for new mechanisms. And while it was decided in Durban to develop these modalities and procedures by the end of this year, given the political divisions on this issue it remains to be seen whether progress will indeed be that fast. To move the process forward it may therefore be useful to consider promoting pilot activities similar to the Activities Implemented Jointly pilot phase launched at COP 1 and the REDD+ demonstration activities that were encouraged at COP 13.

Zusammenfassung

Die Konferenz in Durban hat beschlossen, einen neuen marktbasierten Mechanismus zu entwickeln, der große Teile der Wirtschaft eines Landes abdecken soll. Die Details der Umsetzung sollen auf der Konferenz Ende diesen Jahres in Katar beschlossen werden. Die Frage ist jedoch, welche Entwicklungsländer tatsächlich in der Lage sein würden, solch einen neuen Mechanismus umzusetzen. Die Einführung des EU-Emissionshandelssystems hat aufgezeigt, welchen Herausforderungen sich selbst fortgeschrittene Länder entgegen sehen, wenn sie einen Kohlenstoffmarkt einrichten. Dieses Papier hat daher zum Ziel, die wesentlichen Bedingungen für die Umsetzung neuer Marktmechanismen (NMM) zu analysieren. Zusätzlich zu einer theoretischen Diskussion betrachtet es die Fälle China und Mexiko.

Kohlenstoffhandel kann entweder auf der Regierungsebene oder auf der Anlagenebene statt finden. Im ersten Fall müssen die folgenden Elemente behandelt werden: die sektorale und Treibhausgasabdeckung; die Art und Stringenz des Emissionsziels; und Regeln für Monitoring, Berichterstattung und Verifizierung. Wenn ein System auf die Anlagenebene herunter gebrochen wird, sind zusätzliche Aspekte relevant: die Definition und Anerkennung von Zertifikaten; die Festsetzung von Zielen auf Anlagenebene; Regeln zur zeitlichen Flexibilität; Monitoring, Berichterstattung und Verifizierung; Register und Transaktionslog; Marktregulierung; und Anreize zur Beteiligung des Privatsektors.

Die Herausforderungen bei der Schaffung eines Marktmechanismus, der große Teile der Wirtschaft abdeckt, sind beträchtlich. Die Inventare der nicht-Annex I-Staaten unterlagen bisher nur schwachen Anforderungen und die meisten Entwicklungsländer haben erhebliche Kapazitätsmängel. Die Anlaufzeit kann auf mindestens 3-5 Jahre geschätzt werden. Die Beispiele von Mexiko und China zeigen auf, welchen Hindernissen sich selbst relative fortgeschrittene Entwicklungsländer gegenüber sehen. Herausforderungen sind insbesondere monopolistische Marktstrukturen und mangelnde Kapazitäten zur Emissionserfassung.

Wesentliche Maßnahmen zum Aufbau von Kapazitäten sind bereits auf dem Weg wie etwa die Partnership for Market Readiness. Die Anforderungen im Detail zu identifizieren ist allerdings schwierig, so lange die Klimaverhandlungen noch nicht die detaillierten Regeln für den neuen Mechanismus vereinbart haben. Und während in Durban entschieden wurde, dies bis Ende diesen Jahres zu tun, bleibt angesichts der politischen Meinungsunterschiede abzuwarten, ob Fortschritte tatsächlich so schnell erzielt werden. Um den Prozess vorwärts zu bewegen, könnte es daher nützlich sein, Pilotaktivitäten in Betracht zu ziehen, ähnlich zu der auf COP 1 gestarteten Phase der Activities Implemented Jointly und den von COP 13 ermutigten Demonstrationsmaßnahmen zu REDD+.

1 Introduction

Industrialised countries are advocating strongly for the introduction of new market-based mechanisms that should cover whole sectors or “broad segments of the economy”. The Durban conference decided to establish such a new mechanism as well as a framework for “various approaches” that may be developed bottom-up by individual Parties (Decision 2/CP.17). The implementation details are to be agreed at this year’s conference in Qatar.

The question is, however, which developing countries would actually be able to implement such new mechanisms. The introduction of the EU ETS highlighted the many challenges that even the most advanced developed countries face when establishing a carbon market. The difficulties encountered by the EU did not only relate to installation-level operation of the system, which may not necessarily be applicable for systems in developing countries, but also to data gathering, setting appropriate sectoral targets and measuring, reporting and verifying emissions and reductions.

This paper therefore aims to explore the essential prerequisites for the implementation of new market mechanisms (NMM). The UNFCCC decisions have defined a preliminary list of requirements. Inter alia, new mechanisms should

- Stimulate mitigation across broad segments of the economy.
- Safeguard environmental integrity.
- Ensure a net decrease/and or avoidance of emissions.
- Ensure good governance and robust market functioning and regulation.

This paper seeks to elaborate in more detail what requirements developing countries would need to fulfil in order to achieve these very general overall requirements.

The first chapter will briefly introduce the different types of NMM that have been recently discussed to serve as basis for the analysis. It will focus on differing design features and notable differences. The second chapter – the core of the paper - will outline and categorize preconditions that would need to be met nationally in order to implement an NMM. Apart from basic requirements such as sufficient sector size, the paper will address factors of institutional capacity, environmental integrity as well as economic factors. As a tentative third step, China's and Mexico's New Market Mechanism readiness will be analysed along the factors identified. Mexico has shown high potential for the establishment of market mechanisms in the past. China also has expressed a high interest in developing new market mechanisms, but faces a series of implementation challenges. A conclusion sums up the findings of the previous chapters and considers current and future needs and challenges in New Market Mechanisms.

2 Types of New Market Mechanisms Proposed by Parties

Sectoral approaches have been discussed for almost ten years now in the hope that they will be able to deal with some of the shortcomings of the current CDM and allow for larger-scale emission reductions. Five basic types of mechanisms have been proposed in the negotiations, as illustrated in the table below: a project-based system, sectoral crediting, sectoral trading and NAMA crediting (UNFCCC 2012; see also Sterk 2011a).

Table 1: Types of Proposed New Mechanisms

	What	Proposed By
Project-Based	Similar to CDM and JI	China, Japan
Sectoral Crediting	Decoupled from specific activities, credits are awarded if emissions from a sector are kept below a pre-defined level	EU, AOSIS, Norway, Papua New Guinea
Sectoral Trading	Decoupled from specific activities or policies, allowances are issued ex ante based on a sectoral target, with penalty for missing target	EU, AOSIS, Norway, Papua New Guinea
NAMA Crediting	Crediting of specific NAMAs or based on sectoral thresholds.	South Korea, (Switzerland)
"Net avoided emissions mechanism"	Compensation for not exploiting fossil fuel reserves	Ecuador

2.1 Project-Based

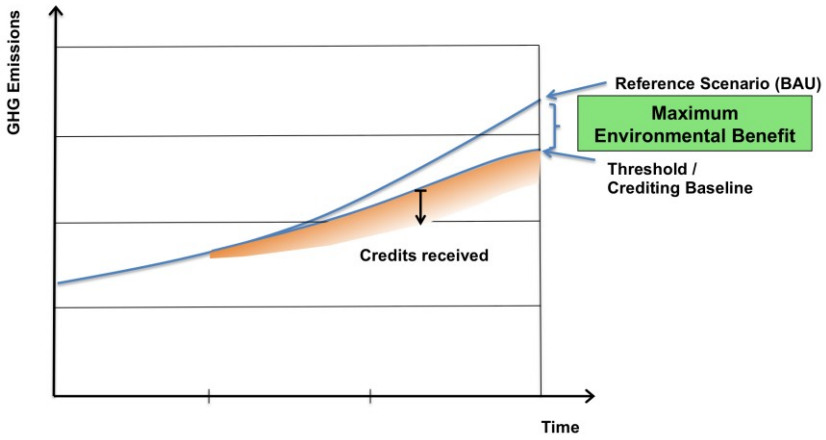
In particular China continues to maintain the position that new market mechanisms under the Convention should be project-based and the modalities and procedures should be similar to the Kyoto mechanisms. Japan (2012) is in favour of both project-based and sectoral approaches and "firmly believes that new market-based mechanisms should allow wide spectrum of approaches, including project-based and sector-based approaches to fulfill (sic!) its function as a whole." The most recent submissions on new mechanisms by New Zealand and the USA also raise the question whether the new mechanism should be project-based or sectoral.

2.2 Sectoral Crediting

Sectoral crediting and trading were initially proposed by the EU and have in the meantime also been taken up by AOSIS and others. Sectoral crediting would be based on an agreed emissions threshold or "no-lose target" at sectoral level. That is, countries would agree on a level of emissions for a sector. This threshold could be either in terms of absolute emissions or intensity-based, for example in terms of emissions per unit of GDP, emissions per unit of electricity generated, etc. The developing country could then undertake actions to reduce its emissions to the agreed level, either unilaterally or with some international support. If emissions are reduced below the target, the

developing country would receive credits. If the target is not achieved, there would be no penalties. As illustrated in Figure 1, the maximum environmental benefit of a crediting system would be the difference between the BAU scenario and the crediting baseline - or lower, if the country misses its target.

Figure 1: Environmental Benefit of Sectoral Crediting

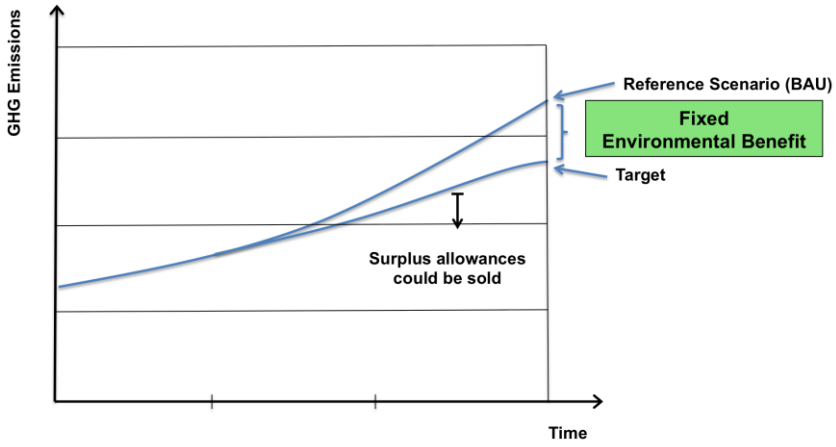


Source: Wuppertal Institute

2.3 Sectoral Trading

By contrast, sectoral trading would follow the cap-and-trade approach. The sectoral target would be a mandatory cap and the developing country would receive tradable units ex ante, essentially equivalent to the assigned amount units (AAUs) industrialised countries receive under the Kyoto Protocol. If the country manages to reduce its emissions below its target, it would thereby achieve a surplus of trading units which it could sell. If the country does not achieve the sectoral target, it would need to buy trading units to cover the shortfall. As illustrated in Figure 2, a trading system would therefore have a fixed environmental benefit.

Figure 2: Environmental Benefit of Sectoral Trading



Source: Wuppertal Institute

In its most recent submission, the EU has presented a detailed proposal on modalities and procedures for a new market-based mechanism. The proposal outlines detailed components of an internationally recognised mechanism, including governance and outline of a possible NMM cycle, requirements for participation, determination of sector coverage, methods and criteria for the calculation of baselines, the determination of crediting thresholds or sector targets, length of crediting or trading periods, MRV provisions, provisions for the issuance of trading units, institutional arrangements, review provisions, relationship to the CDM, timetables for implementation, and financing of the system.

2.4 NAMA Crediting

As for NAMAs, from the negotiations so far it appears that NAMAs will be defined very broadly to include any type of action that reduces emissions, from specific investments to national policies such as financial incentive schemes or regulations. The proposal to credit NAMAs therefore initially seemed to be related to earlier discussions about allowing the crediting of policies under the CDM. However, in recent years most proposals for crediting NAMAs were hardly different from the proposals on sectoral crediting and trading. A country might implement individual NAMAs such as financial incentives or regulations, but crediting and trading would take place on the basis of a sectoral emissions threshold (see e.g. UNFCCC 2009a and b).

A notable exception is South Korea, which in its 2011 submission does refer to crediting individual NAMAs. South Korea distinguishes NAMAs where emission reductions can be measured more or less easily, and proposes to use "success indicators" as basis for crediting in the latter case. For example, credits might be issued on the basis of the percentage of energy-efficient appliances or the average carbon intensity of the vehicle fleet (UNFCCC 2011). The most recent submission by Switzerland in its 2012 submission also seems to imply that the scope of new mechanisms may not necessarily be sectoral, calling for "rules to define sectors or sub-sectors, policies and measures, technologies or other mitigation actions, as well as gases that can be part of the mechanism".

2.5 "Net Avoided Emissions Mechanism"

Finally, Ecuador has proposed a "net avoided emissions" mechanism for countries whose economies are so far based on extractive industries and who want to transform their economies. This proposal follows Ecuador's Yasuni initiative, by which it would commit to not exploit the fossil fuel reserves below the Yasuni national park if it is compensated for the revenue which it would thus forego. According to the submission, such compensation could be either in the form of direct compensation outside from the market, or through market mechanisms.

3 Elements of Market Readiness

This chapter aims at categorizing the preconditions a country should fulfil in order to successfully implement an NMM that covers whole sectors or "broad segments of the economy".

Such a mechanism would operate at the government level, at least in the first instance, as private entities can hardly take responsibility for entire sectors. This would introduce an intermediary (the developing country governments) between the carbon market and those who actually undertake the investments. It would therefore be necessary for the developing country governments to implement appropriate policies to pass the incentive on to investors or those affected by the policies.

As an alternative to governments implementing policies, sectoral mechanisms may also be devolved to the installation level. While not explicitly envisaged in the negotiation texts, not only sectoral trading but also sectoral crediting mechanisms could be broken down to the installation level (Marcu 2009). The process would be similar to an allocation in a cap-and-trade system, but instead of allowances each installation would be given a crediting baseline.

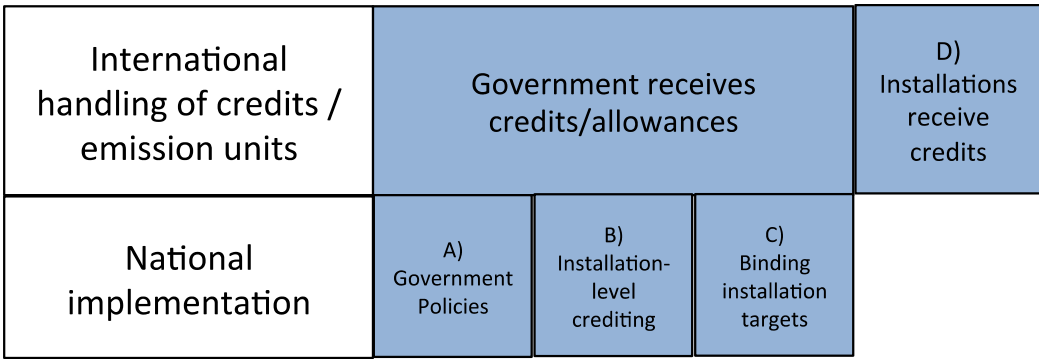
On this basis, the following basic options can be conceived:

- A) The government receives credits/allowances and implements non-ETS policies and measures to reduce emissions. These may be either mandatory "sticks" or voluntary "carrots".

- B) The government receives credits/allowances and defines individual targets for the installations within the sector. If an installation beats its target, it receives credits from the government. If not, there are no penalties.
- C) The government receives credits/allowances and defines binding installation-level emission targets, possibly forming the basis for a national ETS.
- D) IETA (2010) has also proposed that instead of going through governments sectoral crediting might be established with a direct relation between the installations and the international authority. In this version, installations would receive credits directly from the international authority if they beat their installation-level crediting thresholds.

These different options are illustrated in Figure 3. These are prototypical archetypes; in practice overlaps and combinations are likely. In particular, even if a binding ETS is implemented, it is likely that other policies will also be pursued in parallel, as is done in the EU.

Figure 3: Options for Implementation at Government or Installation Level



Source: Wuppertal Institute

Countries will need to make decisions on various elements when developing such a system. The list of elements varies depending on whether the scheme is to be policy-driven or credits/allowances are to be issued to individual installations.

In a policy-driven scheme (option A), the following elements need to be considered

- The sector and GHG coverage of the scheme;
- The type and stringency of the emission target;
- Provisions for monitoring, reporting and verification.

If credits/allowances are to be issued to individual installations (options B-D), additional considerations apply

- The definition and recognition of trading units;
- Setting of installation-level targets;
- Provisions for temporal flexibility, i.e. the compliance period, allowance validity, banking and borrowing;
- Provisions for monitoring, reporting and verification;

- Registry and transaction log to track trading units;
- Market governance.

The following will discuss the requirements that need to be fulfilled to be able to operationalize each design feature.

3.1 Requirements for Policy-Driven Schemes

3.1.1 The Sector and GHG Coverage of the Scheme

Under the Kyoto Protocol, the commitments countries have taken on relate to a basket of the most important greenhouse gases.[1] Nevertheless, a NMM may cover solely one or several of them. Coverage of as many gases as feasible seems desirable in order to maximise the environmental effectiveness of the regime and to create more diverse abatement options. Schemes which include more gases may allow participating entities to reach their reduction targets at lower cost since reductions of non-CO_2 greenhouse gases are often more cost-effective than CO_2 emissions reductions (Blyth and Bosi 2004). However, there are technical difficulties in monitoring and calculating non-CO_2 emissions, which may lead to concerns over the accuracy of the results obtained (Bode 2003). Therefore, when opting for a broader gas coverage it has to be ensured that the emissions of the non-CO_2 gases can be determined adequately in order to secure the legitimacy of the traded units. This was one of the reasons why the EU ETS initially started out only with CO_2 and is now being successively expanded to other gases.

The feasibility of MRVing CO_2 emissions also varies from sector to sector. To illustrate, generally the energy sector covers a limited range of installations with a clear-cut usage of fuels that can be relatively easily determined. By contrast, sectors that cover large amounts of individual entities with very variable energy uses, such as the building sector, need to collect much larger and more complex data sets for accurate monitoring.

If run at government level, the size of the sector covered by the NMM is not so much of an issue. Especially policies and measures such as efficiency standards or feed-in tariffs will often make sense, even if the number of installations in the sector is rather small.

Also, decisions must be taken on the sector boundaries, which might not always be clearly defined, and which may lead to carbon leakage. For instance, a power plant for the generation of electricity for a railway system might be counted towards the power or the transport sector, and as such might or might not be covered by the set sectoral requirements. In order to overcome these difficulties, it might be helpful to look at experience gained in already existing mechanisms, such as the EU ETS (Asroud, Baron and Karousakis 2010).

[1] Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6). Annex A of the Kyoto Protocol.

3.1.2 The Type and Stringency of the Emission Target

The proposed new mechanisms imply to establish the baselines or targets at an aggregate level instead of for specific activities. They would thus have the advantage of removing the necessity to determine the additionality of individual investment decisions. Instead, the implementing country would have to establish a robust sectoral greenhouse gas inventory in order to obtain reliable data on past and current activities and corresponding emissions in order to determine a meaningful baseline for the proposed sector activities. So, even though problems of individual additionality criteria may be avoided, there are new challenges in setting sectoral baselines.

The quantification of emission reductions at aggregate levels would have to rely on modelling and projections, which always possess a degree of uncertainty. Baseline projections need to be based on assumptions about the future impact of current policies, the development and penetration of technologies and the development of economic activity. Uncertainties are likely to be especially great for countries that are growing rapidly and where the GHG-intensity of production can vary significantly over the period of the baseline projection, either through technology choice or technology developments. Also, many developing country economies rely heavily on manufacturing and commodities, which are more sensitive to economic fluctuations than service sectors. Growth rates are therefore more variable and difficult to predict in developing than in industrialised countries (Helme et al., 2010). Ellis and Moarif (2009) highlight an example from China, where the IEA in 2000 projected that electricity generation would be 1.5 trillion kWh in 2005, whereas actual generation in 2005 ended up at 2.5 trillion kWh.

Schneider and Cames (2009) identify six basic options for determining baselines for sectoral mechanisms:

- Deviation from BAU: This most basic version of baseline-setting would involve a politically agreed percentage that the sector was to deviate from its business-as-usual emissions. This option would solely require a robust BAU projection. Which is, however, difficult as noted above.
- Mitigation potential/cost: For this option, the targeted sector's BAU baseline and its maximum cost-neutral mitigation potential would need to be determined. This potential deviation from BAU would then be set as the baseline for the sector. This approach would require even more data than the previous one.
- Reference technology emission rates: If a sector possesses a reference technology with a currently lowest rate of emissions per output, this technology could be used as the baseline standard for that technology. Japan's Frontrunner program has used this type of baseline for yearly updated efficiency standards in home appliances. In order to set an appropriate absolute emissions baseline, the sector's production level would have to be estimated.
- Emissions benchmark: Similarly to the emissions benchmark of the CDM, a benchmark could be derived from the top-performing installations in the sector or from historical trends. As with the previous option, a projection of the sector's production would be needed for absolute emissions reduction targets. In addition, many sectors are characterised by a large

variety of activities, outputs and services. A benchmark would therefore in principle have to be set for each type of activity, output or service.

- Technology penetration scenario: As an evolution of a single technology penetration baseline, a baseline could also be set using a number of technologies as a portfolio to be established in a sector.
- Policy objectives: A country could set targets for certain policies that need to be met. If it goes beyond its set objectives, it would be eligible for crediting.

Schneider and Cames (2009) also discuss in detail the practical challenges associated with establishing reliable baselines. As it is not possible to verify assumptions on key emission drivers such as future economic growth and fuel prices, it may not be possible to assess proposed baselines purely on technical grounds and in an objective manner. The EU ETS suffered a price crash in its first trading period not least because of a lack of sufficient baseline data. One key political risk for NMMs is that countries have an incentive to inflate their baselines in order to weaken the level of effort they have to make.

These problems pertain largely to absolute emission reduction targets, and can be avoided to a certain extent by using (relative) intensity targets, for example in terms of emissions per unit of GDP or per unit of electricity produced. Changes in these key drivers of emissions would then be factored into the baseline. Intensity targets would probably also be more palatable to developing countries as there would be no danger that the targets might become a “cap on growth”. The disadvantage is that absolute targets provide certainty on the environmental outcome whereas intensity targets do not. In addition, relative targets will probably involve higher administrative costs due to the need to determine the appropriate metric – unit of output, value added, energy input or other – and to monitor this metric in addition to GHG emissions (Baron and Bygrave 2002).

3.1.3 Provisions for Monitoring, Reporting and Verification

Monitoring, reporting and verification (MRV) provisions are crucial for achieving a credible market mechanism since they are key to determining whether each trading unit does in fact correspond to one tonne of emissions or reductions. If the system is not sufficiently robust, this may create incentives to underreport annual emissions (or output, if intensity-based) in order to maximise the number of trading units for sale. In consequence, there would be more emissions than determined by the regulator, that is, the environmental target would be missed (US EPA 2003).

If the mechanism is based on an intensity-based target, a measure of output may have to be created. In doing so, policy makers need to keep in mind that there may be issues of confidentiality, especially if the sector covered is relatively small. Actions taken at the government level may mitigate this problem by aggregating data, so that individual output levels cannot be determined.

The MRV system would ideally be set up in the process of determining reference year, historical emissions and/or output levels of the installations covered, and future projections for the creation of the baseline, and thus be the basis for a national inventory.

Depending on the use of credits generated by the market mechanism, MRV provisions may differ in strictness and complexity. The main use of an MRV system for domestic purposes is to monitor compliance with domestic environment targets, which the regulator is relatively free to set up. On the other hand, if the NMM is aimed at generating units for an international carbon market or another ETS, a national MRV system will have to comply with the rules set up by the market it targets.

In its general guidelines for the monitoring and reporting of greenhouse gas emissions, the EU has identified a number of basic principles that a national MRV system should follow (EU 2004):

- Completeness: The MRV system needs to cover all sources of GHG emissions in the sector it targets.
- Accuracy: Data should be as precise as possible, and uncertainties should be eliminated to the furthest possible extent.
- Conservativeness: If in doubt, emission reductions should be rather under- than overestimated.
- Materiality: Only data really relevant for end users should be included in reports.
- Consistency: Data should be comparable over time; a change of monitoring methodologies should only occur if the new methodologies ensure better, more accurate data.
- Cost effectiveness: MRV systems should provide the highest accuracy possible with the least costs involved.
- Adjustability: It should be possible to adapt MRV systems to use new and improved methodologies if they become available.
- Transparency: all data should be reproducible by other entities.

A system geared towards international trade should probably follow these general guidelines, as for the time being the European Union remains the largest market for emissions allowances worldwide.

3.2 Requirements for Installation-Level Carbon Trading

For installation-level schemes, the same general preconditions as for policy-driven schemes apply. However, they will generally need to be more complex, as the requirements need to be broken down to individual installations instead of the sector as a whole. Thus, especially data collection and MRV systems will be more challenging. On the other hand, installation-level schemes thus imply a more accurate determination of GHG data, and thus can potentially have higher environmental integrity.

As entity-level schemes imply a national GHG market, basic market governance instruments need to be set up for its regulation. Thus, the state has to establish a legal framework in which trading may take place, including accounting rules, a national transaction log, legal penalties for fraudulent behaviour etc., as outlined below. Existing institutions such as Environmental Protection Agencies

or the relevant ministries may serve as hosts and/or enforcement agencies for the scheme, if a government does not wish to create new institutions, and if they have existing experience and knowledge, e.g. from CDM activities.

3.2.1 The Sector and GHG Coverage of the Scheme

In order to set up a new market mechanism, decision makers need to identify sectors to be covered. A sector must be sufficiently large in order to warrant a sectoral baseline instead of CDM-type institution-level crediting. A scheme which covers only a few installations will not have much market liquidity. Also, different types of installations across the same sector need to be taken into account.

Butzengeiger-Geyer et al. (2010) examine 6 economic sectors in 9 non-Annex I countries. Importantly, they find that most sectors in most countries are actually too small to warrant a sectoral approach. In most cases there are only a handful of installations, so a sectoral approach would have no advantage compared to the project-based CDM. Among the 9 countries, generally only China and India have industrial sectors that are large enough to warrant sectoral approaches. However, here the problem is that the sectors usually consist of very efficient large installations on the one hand and large numbers of very inefficient small installations on the other hand. Effectively addressing emissions would mean to include these small installations in a sectoral approach. However, this would cause high costs for monitoring and verification of emissions.

Furthermore, a sectoral mechanism based on an intensity target set up in a sector with very few individual installations may have serious confidentiality issues. In this case, data on the output of individual installations may give competitors sensitive data on the installations' performance. Issuing credits or otherwise awarding actions taken *ex post* may alleviate this problem somewhat, as published data will not show current performance.

Depending on the point of application of the overall limit on GHG emissions in the production and consumption cycle, regimes can either be designed "upstream" or "downstream". In an upstream system, emissions are accounted for at the point of entry of fossil fuels into a country's energy system, with the producers and importers of fossil fuels being held responsible for meeting an emissions cap. By contrast, a downstream regime targets the end-users of energy – usually large industrial consumers of fossil fuels. Whereas in an upstream scheme the covered entities are held accountable for the emissions their goods will produce once consumed, in a downstream scheme the actors are held responsible for their own emissions.

Upstream design has the advantage of extending coverage to most emitting sources, including diffuse ones. Furthermore, monitoring and transaction costs are likely to be lower due to the limited number of participants in the system (FIELD 2000). The data needs in an upstream system are essentially the same as in a policy-driven system as discussed above. However, apart from the fact that market liquidity may be low due to the limited number of participants in the scheme, experts also point to the possibility that upstream entities may simply pass on the costs to consumers, the sensibility of whom to price signals is at least doubtful (Philibert and Reinaud 2004). In addition, an upstream approach does not create incentives for post-combustion technologies such

as carbon capture and storage (US EPA 2003). A downstream system on the other hand also implies a trade-off. A high number of participants, desirable from a market functioning perspective, would in turn involve high administrative costs (Baron and Bygrave 2002).

3.2.2 The Definition and Recognition of Trading Units

Trading systems should ideally have the same quantitative unit of trading based on the Kyoto Protocol, namely metric tonnes of CO_2-eq. This unit can be used both by systems under absolute and relative targets.

It should be noted that different trading units are in existence, such as energy efficiency credits under the Indian Perform Achieve Trade (PAT) scheme. However, these are not transferable to the international carbon market.

3.2.3 Setting Installation-Level Targets

If the sectoral scheme is broken down to the individual installations, a key question is the choice of method for setting installation-level targets. In a crediting system with non-binding targets the basic choices are historic activity or benchmarks. The experience from the EU's national allocation plans highlights the substantial effort that is required for both. Especially approaches based on historic activity have been widely criticized in the past, as they tend to favour large installations with high GHG emissions. Approaches to distribute units according to a standard not directly linked to historic emissions may alleviate this problem somewhat. For instance, emissions per unit of production, or a best technology benchmark could be used as a baseline for the initial setting of targets without privileging installations with high absolute emissions. However, taking this approach requires additional efforts to establish appropriate benchmarks.

In a domestic cap-and-trade system a further option is to sell allowances rather than allocating them for free. Administratively, this is the easiest of the options as all that is needed is a sales platform. Private actors such as stock exchanges can be expected to be eager to offer respective services. Selling allowances may often be more economically efficient, as they create a source of income for the issuing government from the start, while at the same time creating a higher incentive to make use of existing resources, and circumventing controversies of free allocation methods. However, as initial costs for participants may be high, a system may transition from free allowances to partial or full auctioning, as is the case with the EU ETS (US EPA 2003).

3.2.4 Provisions for Temporal Flexibility

These provisions will have to be addressed politically, but do not constitute a technical barrier. The first issue in this context is the length of crediting or trading periods. Long periods enhance investor certainty and hence economic efficiency. However, they make it difficult to correct problems, for example if baseline calculations turn out to have been faulty. A possible compromise may be to start with short periods and move to longer ones once the robustness of the system has been proven.

In cap-and-trade systems a further issue is whether banking and borrowing of allowances should be allowed. Banking allowances for future trading periods allows for more flexibility in the system and may encourage reductions of emissions early on, as entities may accumulate allowances and sell them at a higher price in later trading periods. However, if too many allowances are allocated early (e.g. because of miscalculation of needed allowances), banking makes a correction more difficult.

Borrowing is more problematic from an environmental perspective, because it cannot be guaranteed that present inaction that is covered by borrowing will be corrected in future trading periods, for example if a company goes bankrupt. So, even though borrowing may lower initial costs for entities in the sector, decision makers will have to determine if they are willing to take this risk.

3.2.5 Provisions for Monitoring, Reporting and Verification

An installation-level market mechanism has to fulfil the same basic requirements for an MRV system as one set up at government level. Measurement and reporting can be done via the national inventory system, which however would have to cover a sector's individual installations in a more detailed manner, with installation-level measurement and reporting of emissions (and output, if baselines are intensity-based).

In order to maintain consistency of measurement and verification data, a monitoring standard including regular monitoring reports would need to be defined, and agreed upon with the entities that verify the emissions data. Instead of having a systematic verification, a government could also do sample checks and apply high penalties for non-compliance, as is done by New Zealand (Rashbrooke 2010).

Systematic validation by independent entities increases the instrument's credibility significantly. Therefore, verification could be outsourced to third parties (in the private sector) with experience in the field, such as the Designated Operational Entities (DOEs) in the CDM. Accreditation of third-party verifiers would have to rely on a set of rules and regulations outlining the eligibility of entities for verification, either by the government or according to an international standard, such as criteria defined by the CDM Executive Board (Aasrud, Baron and Karousakis 2010).

However, looking at CDM DOEs also illustrates the limited capacity in most developing countries. Out of the currently 41 accredited DOEs, only 11 are from developing countries. Five are from China; three are from India and one each from Colombia, Malaysia and South Africa.[2]

3.2.6 Registry and Transaction Log

In order to track trading units, a registry is a key part of a domestic trading system, fundamentally allowing market transactions to take place. As part of the registry, a transaction log is also needed to trace units across transactions. Both are mainly a matter of IT database technology, but a country setting up a market mechanism will need the capacity to establish and maintain such a system,

[2] CDM: List of DOEs, http://cdm.unfccc.int/DOE/list/index.html, accessed 10 April 2012.

including the capacity to prevent hacking.

In the case of international crediting, a registry and a transaction log are still necessary, but do not necessarily have to be installed at the domestic level. In this case, international institutions would be able to fulfil the registry function (Aasrud, Baron and Karousakis 2010).

3.2.7 Market Governance

Both crediting and trading schemes need institutionalised oversight in order to work as intended. The following functions would need to be fulfilled (Aasrud, Baron and Karousakis 2010; Schneider and Cames 2009):

- Development of the scheme and international submission: Substantial work will need to be done to develop a sectoral scheme, including collection of sector-specific data, identification of mitigation potential and costs, development and planning of policies, measures and mechanisms to provide incentives for the sector to reduce emissions, and an evaluation of the potential emission reductions from these instruments. Based on this work, a template for proposing the mechanism needs to be filled in and submitted to the international regulatory body for review and approval.
- Trading regulation: The scheme needs to be strongly integrated with the country's legal framework. Independent of the responsibility to regulate the scheme, clear accounting and tax rules need to be laid down by the government in order to ensure clarity for investors and international trust in the robustness of the country's scheme.
- Issuance of trading units: A national registry including a transaction log is needed to record the emissions liabilities and to keep track of the transaction among participants.
- Compliance: If installation-level targets are binding, sanctions that are sufficiently severe to deter non-compliance are crucial. As is having institutions that are actually able to enforce sanctions. In addition, it should be ensured that an appeals process is set up within a government-independent legal court.
- Verification of GHG amounts and system performance: In order to ensure credibility of the credits generated, these must be validated either by an internal or external auditing. In the case of external auditing, responsibility for accreditation of third party verifiers must be given to the institution in charge.
- Stakeholder involvement: The entity responsible for the functioning of the scheme needs to consult with the relevant stakeholders in order to gain support, and to build knowledge and institutional capacity to facilitate the implementation of the scheme.

These functions could be fulfilled by a centralised agency, or distributed across different organisations both with and outside the government. In any case, even if several institutions are involved one of them should have the competence to coordinate all activities. In addition, Schneider and Cames (2009) suggest that a steering committee should be established to supervise the work of the coordinating agency. This steering committee might include representatives from government, industry, and civil society.

3.2.8 Private Sector Participation

If the individual installations in a sector are assigned their own individual crediting thresholds, installation owners have a direct incentive to reduce emissions as long as their abatement costs are lower than they price of carbon. A further advantage is that they usually have a much clearer picture than governments how and to what extent they can reduce their emissions. Finally, the regulatory risk would be much lower than under the CDM as there would be no question about eligibility. Due to the low regulatory risks installation-level crediting might even be able to actually drive financing decisions (Marcu 2009).

However, the proposals for sectoral crediting and sectoral trading envisage that carbon units would be issued on the basis of the overall sectoral performance. This raises the question of how to handle situations where some individual installations successfully reduce their emissions but the sector as a whole does not. If installation operators that reduce emissions run the risk of not being rewarded because of what happens at other installations that are beyond their control, the system would hardly provide an incentive to reduce emissions. The crediting of individual installations would therefore need to be ensured irrespective of the performance of the sector as a whole. As the submission by the Centre for European Policy Studies notes, clear accountability and responsibility should exist for the reductions, and the benefits that accrue from them, as well as for failure to deliver. Otherwise, the NMM would become a government- to- government tool (CEPS 2012).

The literature discusses various options for solving this problem (e.g. Baron, Buchner, Ellis 2009; Helme et al. 2010; Marcu 2009; NERA 2011):

- One option would be for the host country government to take on the risk and agree to provide credits to installations that reduce their own emissions regardless of the overall sector performance. However, this does not reduce the risk, it merely shifts it from the installation owners to the host country government, and it seems doubtful whether host country governments would be willing to take on that risk.
- Another option, which would probably be politically more acceptable to developing countries, would be for the host country government to hold back a share of the credits issued to form a reserve. However, if many installations do not achieve their targets, such a reserve may turn out to be too small. This option therefore reduces the risk but does not remove it.
- The government could also try to reduce the risk by implementing additional policies and measures to reduce sectoral emissions. However, if is the government that ensures sectoral performance, one may wonder whether the government should then not retain the credits to finance its policies and measures, rather than issuing them to installations.
- The most straightforward approach may be to make the installation-level targets mandatory with penalties attached. These could either be financial penalties, which could be used by the government to purchase trading units if needed, or obliging the companies themselves to purchase carbon units for their excess emissions.

Making the installation-level targets mandatory would essentially be equivalent to introducing a cap-and-trade system. The main difference would be that carbon units would be issued ex-post whereas in a full cap-and-trade system units are issued ex ante. Moving to full cap-and-trade in a

sector would probably be the best option for maximising private sector participation. As units are issued ex ante, they could be traded under standardised contracts. This would probably result in exchange-based trading, which would further facilitate operation of the mechanism. Entities could manage their allowances as assets and sell them whenever they liked, rather than having to wait for the ex-post assessment of their performance (Marcu 2009).

Yet another possible solution would be to not go through host country governments and not issue credits on the basis of the overall sectoral performance, that is, contrary to what proposed by the EU. Instead, IETA (2010) proposes that sectoral crediting might be established with a direct relation between the installations and the international authority. In this version, installations would receive credits directly from the international authority if they reduce emissions below their installation-level crediting thresholds, irrespective of how the sector as a whole performs.

The involvement of foreign investors would inter alia depend on whether the domestic implementation scheme is based on the same units that are issued to the host country government, which are internationally fungible, or the government creates a domestic currency as has been done in the EU ETS. In the latter case the units would only have value within the domestic scheme and would not have any direct value to outside investors.

Finally, the scope for private sector participation also depends on the sectoral characteristics. If the majority of installations are owned by public or governmental entities, the government does not have to create incentives but may implement emission reduction measures directly. This applies for example to the power sector in many developing countries, including large ones such as India, Indonesia or Mexico (Butzengeiger-Geyer et al. 2010)

4 Examples for Potential Implementation

The complexity of the proposed new mechanisms gives rise to the question which countries would actually be able to make use of them. On the one hand, poorer countries might find it easier and cheaper to implement policies and measures than to try to attract individual investment projects. On the other hand, given the level of technical capacity and data required, it can be expected that only the most advanced developing countries would be able to make sectoral mechanisms work. The following therefore discusses two of the countries that are usually mentioned as candidates for NMMs, Mexico and China.

4.1 Mexico

Mexico has been one of the most progressive counties in the field of greenhouse gas mitigation strategies. As early as 2007, the Calderón administration laid out plans to strengthen Mexico's carbon policies with the creation of its National Climate Change Strategy (ENAC). Its overall National Development Plan 2007-2012 (PND) became the basis for Mexico's Special Climate Change Pro-

gram 2009-2012 (PECC), with a long-term vision for the country, and identifying mitigation, adaptation and transversal policies for the energy sector as key elements of a national climate change policy. The program includes an aspirational reduction target of cutting 2000 emissions in half by 2050, amounting to 260.45 $MtCO_2e$. However, the PECC envisages foreign investment of 6.6 billion USD in order to reach that goal. Mexico's domestic investment of 7 billion USD would only be able to account for 36% of the targeted reduction.

Mexico has significant GHG reduction potential in the electricity generation, petroleum-based fuel production and consumption as well as land use and forestry sectors (Johnston et al. 2009). These sectors are also identified in the Mexico's Special Climate Change Program 2009-2012 (PECC), but without financial support, actions taken will not reach their full potential. Below, we take a closer look at the electricity and petroleum sectors.

Mexico's **electricity sector** is dominated by a state monopoly (CFE) in transmission and distribution. Generation of electricity is also largely state-owned (65% in 2009), even though there is a growing number of small independent producers. The sector is regulated by an autonomous body, the Energy Regulatory Commission (CRE). Tariffs vary widely among different consumers, with significant subsidies for residential customers (Burtraw et al. 2009). Electricity production contributed about 26% of domestic emissions in 2006, with a high growth rate of demand in recent years.

Due to the monopolistic nature of the sector, a sectoral mechanism would need to be mainly operated as an intra-company scheme (possibly accompanied by a sector-wide program of a smaller scale). In this, individual plants within the company would be treated as independent entities, and an intra-company cap-and-trade scheme under governmental oversight would be created (Burtraw et al. 2009). Alternatively, the sector would also lend itself particularly well to a government-run scheme as the Mexican government could directly prescribe any measures it deems necessary.

The **petroleum sector** is also a state-owned monopoly. Mexico's PEMEX oil and gas company is responsible for all upstream extraction and production as well as downstream petroleum products. PEMEX itself had a share of ca. 12% of domestic emissions, but the transport sector (which almost exclusively uses PEMEX products) contributes another 18%, bringing the total up to about 30% of domestic greenhouse gas emissions in 2009.

In late 2008, facing falling oil production, reforms for PEMEX were passed that inter alia create a new advisory board for long term strategy and the National Hydrocarbons Commission as a regulatory body for the sector that would be able to set standards and find international best practice examples to improve efficiency. However, implementation of the reforms has been slow-going.

As a state-owned company, PEMEX' revenues go to the Mexican treasury instead of being freed for renewed investment. Given already scarce capital due to falling oil production, those limited funds are more likely to be used for exploration and production than for GHG reduction activities, which do not yield short-term financial gains. Also, a lack of competition and a budget determined by the state (i.e. not performance-based) do not give the company a high incentive for efficiency improvements. Even if the 2008 reforms are a first step forward, the sector may need more structural reforms to overcome these barriers (Burtraw et al 2009).

In order to allow sectoral crediting or trading in the petroleum sector, an internal mechanism would need to be created in a similar fashion to the electricity sector. In fact, such a system had been put in place as a voluntary market 2001-2005, with 25 units of PEMEX participating in the scheme. The aim of the former was to stimulate competition among the participants and to identify cost-effective abatement options and best practice examples. Consequently, PEMEX could already draw from its past experience if Mexico was to set up a sectoral mechanism in the petroleum sector (Burtraw et al. 2009). Alternatively, here as well a government-run scheme would probably be a viable option.

Mexico is the only non-Annex I country that has so far submitted four national communications under the UNFCCC. In addition, it has initiated a voluntary greenhouse gas accounting and reporting program. It is hosted and coordinated by the Mexican Environment Agency (SEMARNAT) and receives technical support by the World Resources Institute and the World Business Council on Sustainable Development. In 2007, the GHG program was officially adopted into the National Strategy on Climate Change, and again in 2009 in the Special Program on Climate Change. The program provides trainings and technical assistance to participating entities free of cost. Participants in the sector commit to conduct and publicly report corporate GHG inventories. The program is expanding into accounting of greenhouse gas reduction projects.

The program claims broad participation of companies, with 100% of the cement, oil, and brewery sectors, and 75% of steel and mining. For 2012, it has set a target of accounting for 89% of Mexico's national emissions in generation and use of energy in the energy and industrial processes sectors, and to design and implement a GHG emissions reductions registry platform (www.geimexico.org).

In 2011, Mexico applied for and received an initial grant of 350.000 USD by the World Bank's Partnership for Market Readiness (PMR). According to its letter of interest, the funds received "may help in developing solid MRV systems and tools, to help, among others, manage double counting risks, setting the boundaries for NAMA crediting, establish criteria and conditions for monitoring and record keeping, and develop a registry system on carbon funding, that may serve as clearing house on the different markets available." Furthermore, the PMR finance should aid in the improvement of Mexico's regulatory framework, capacity building, and institutional strengthening (Mexico 2011a).

Currently, Mexico is in the process of passing a new General Law on Climate Change, sending a strong signal of the country's commitment to combat climate change. The law encompasses the establishment of an Interministerial Commission on Climate Change, the creation of a climate fund, the establishment of an emissions market that can include international transactions, requirements for mandatory emissions measurement, reporting and verification, and a public emissions registry that will cover emissions sources from a broad range of sectors (CCAP 2012). It does not, however, include concrete policies and measures, but mainly consolidates Mexico's institutional structure in this field. Provisions on a domestic trade system do not mandate the establishment of a domestic ETS, but open up possibilities for international trading, if such a system were put in place (Höhne et. al 2012: 32). The bill has passed both the Mexican House and the Senate with large majorities, and now awaits signing into law by president Calderón (Schmidt 2012).

4.2 China

The People's Republic of China is currently the largest emitter of greenhouse gases worldwide. Through CDM activities in the country, it also represents the largest source of GHG abatement certificates to be used in other carbon markets. There is clear interest to develop and establish a carbon emissions trading system: China is currently envisaging to first develop several pilot systems at city and provincial level which are to form the basis for a national system that is to start in 2015. Pilot schemes are to be developed before 2013 and shall be based on provincial energy consumption targets that are derived from the national energy consumption target of approx. 4 billion tonnes of standard coal in 2015.

However, the designated provinces are currently envisaging very different design routes. For instance, Guangdong is likely to put in place a trading system based on absolute emission caps, and has in fact already announced a CO_2 cap of 660Mt CO_2 in 2015 (140 Mt up from 2010) (Chen 2012b). The province has employed a number of local research institutions to put forward proposals for implementation. It has been announced that the EU ETS will serve as a model for the provincial trading system, with as many aspects as possible to be applied locally, including emissions target modelling, sector impact assessments, and allocation method decisions (Han et al. 2012).

Tianjin indicated that its trading scheme might be based on energy saving credits (Reklev 2011a). The Asian Development Bank has approved a 750.000 USD grant for the design of Tianjin's ETS. Its objectives are to provide policy advice, design the ETS (including trade rules and regulatory system, and to commission the trading platform and registry (ADB 2011). The setup of the pilot also aims at providing lessons learned for a future national ETS (Allan 2012).

Beijing has recently released draft rules for its pilot scheme that indicate three classes of possible emissions certificates. In their recent publication for Sandbag, Yu and Elsworth (2012) classify these as "upstream direct emissions, downstream indirect emissions and 'baseline and credit' project emissions to be used as offsets" (Yu and Elsworth 2012: 17). China has also announced intentions to impose absolute caps on specific industries such as steel and cement and to establish carbon trading programmes on that basis (Reklev 2011b). At this point, none of the provinces have finalised the rules for their schemes. At the same time, however, first draft proposals have been put forward by the Chinese Academy of Social Sciences to introduce new national climate legislation that could lead to the introduction of a nationwide ETS within the next three to five years (Chen 2012a).

China still has limited capacity in the field of GHG inventories and statistics. The country's second National Communication, planned to be completed before 2012, still has not been finished, with the preceding one dating from 2004 (China 2004). Without solid GHG data, it will be hard to set credible baselines (see above). In its 2007 World Energy Outlook, the IEA found that there are significant discrepancies among domestic Chinese energy statistics and international standards (IEA 2007). Han et al. (2012) draw a similar conclusion: "China still lacks essential legislation and enough third-party verification companies to support domestic carbon trading" (Han et al. 2012: 43). As China's Expression of Interest to the PMR indicates, China is aware of this shortcoming, and plans to "study approaches for emissions accounting, monitoring and verification, accredit in-

dependent third party for GHG emissions verification, formulate standards for emissions monitoring and verification, and organize relevant organization to formulate emissions standards for products in key sectors" (China 2011).

The process of setting up a carbon trading system in China could glean valuable insights from the country's experience in the reduction of sulphur dioxide emissions. In this field, China already has a number of trading schemes in place. However, a recent study by Schroeder (2011) finds that these schemes face similar challenges to the ones identified for Mexico in the previous chapter. As the companies involved in trading are state-owned, the overall market structure of the power and heavy-industry sector remains largely monopolistic. Therefore, a lack of competition and profit-maximizing behaviour of the companies' management leads to a not optimally-functioning market. Also, there is insufficient enforcement of compliance to set targets, as the local environmental protection bureaus lack power. Finally, the capacity to adequately MRV the individual emitting entities remains very limited. As Schroeder concludes, "As a result of these shortcomings, the pilot SO2 ETS in China have not delivered many successful trades in emission permits, let alone actual emission reductions. Instead, most of the trades were conducted because they were politically motivated" (Schroeder 2011).

Han et al. (212) come to similar conclusions concerning the prospects for carbon emissions trading systems in China. They find that China at the moment lacks technical knowledge, human resources and sufficiently market-based behaviour of the key market participants in order to set up a working carbon market. They do not see a working market in China in the nearer term: "Even if a carbon market were effectively set up in China at this point, traditional corporate behaviour and resistance could prevent any substantial trading from taking place. Changing the behaviour of financiers and the industrial workforce could take years" (Han et al 2012: 46f).

Valuable lessons may be learned from China's CDM experience. In developing this field, China has already made significant institutional steps to the establishment of a carbon market. In order to overcome overlap among responsible ministries, China has put into place the National Coordination Committee for Climate Change (NCCCC), which coordinates climate change activities across ministries under the oversight of the National Development and Reform Commission (NDRC). For the advancement of CDM activities, China has also established a clear policy framework and several regional initiatives, and has sought to integrate its industry in the process (Vieweg et al. 2009: 31f).

However, these efforts need to be strongly scaled up in order to meet the requirements of sectoral approaches with a link to the international carbon market. The NCCCC and the NDRC may not have enough capacity to overcome competing interests from within the relevant ministries, which themselves may be highly influenced by the industries in the sector they oversee. Similar to, or perhaps even more so than in Mexico, the problem of state ownership of the relevant industries pertains: Vieweg et al (2009) found that "the large five state-owned power generation companies have significant influence over government energy policy, weakening the authority of policy-making bodies in the NDRC" (Vieweg et al. 2009: 33).

Helme et al. (2010) similarly find significant limitations in data availability and host country administrative capacities. They therefore propose that a mechanism based on technology objectives may for the intermediate future be rather more suitable for China than an emissions-based approach. As examples of possible technology objectives they mention reducing the share of clinker in cement production, replacing inefficient vertical shaft cement kilns, increasing the share of iron and steel facilities using coke dry quenching technology, or decommissioning inefficient old plants. Helme et al. (2010) suggest that technology objectives would fit well into China's overall economic planning process and their achievement could be readily MRVed without requiring collection of comprehensive emissions data in the sector.

China participates in the World Banks Partnership for Market Readiness, and has received an initial grant of 350.000 USD for the establishment of structures to promote carbon markets. This grant shall be used to further develop the regional carbon trading pilots, and to strengthen China's GHG accounting system at the national and local level. China has identified partners in domestic research as well from its industry to help with research and development. Ultimately, these steps shall serve to establish a domestic carbon trading scheme in the mid-term (China 2011). At this point in time, China has not made it clear if such a system will be on a domestic level only, or involve a certain amount of international trading as well (Chen 2011).

5 Conclusions

The challenges in establishing market mechanisms that cover a broad segment of the economy are formidable. Countries will need to establish robust inventories and projections of future emissions in order to allow credible target-setting and MRV. The challenge becomes even more complex if the sectoral target is to be broken down to the individual installations. Table 2 below summarises the respective requirements.

Non-Annex I inventories have so far been subject to rather lenient requirements and most developing countries have serious capacity constraints. While they are entitled to full cost coverage in the preparation of their inventories, this support has so far been project-based for each individual submission. It has therefore been episodic, which has made it difficult to maintain inventory capacity on a continuous basis (Breideneich and Bodansky 2009). While the Durban decisions provide for a higher frequency of reporting and more stringent requirements, putting these provisions into practice will take time. Even among Annex I countries the quality of reporting has not always been up to requirements. The Kyoto Protocol's compliance committee has had to suspend several countries from using the Kyoto mechanisms due to weaknesses of their national MRV systems (Sterk 2011b).

Aasrud, Baron and Kourasakis (2010) note that it took Annex I countries 10-15 years to establish comprehensive national time-series inventory data. The time required for non-Annex I countries would probably not as long as many non-Annex I countries already have experience with develop-

ing national GHG inventories and NMMs could seek to first cover sectors with good data availability.

Table 2: Requirements for Policy-Driven Schemes and Installation-Level Carbon Trading

	Requirements for Policy-Driven Schemes	Requirements for Installation-Level Carbon Trading
Sector and GHG Coverage	Data needed at aggregate level, e.g. national fuel statistics	Data needed at installation level, sector should have high number of installations for sectoral scheme to have an advantage over CDM
Type and Stringency of Targets	Need current data and projections at aggregate level, e.g. national fuel statistics If intensity target, also need output data	Need current data and projections at installation level If intensity target, also need output data
MRV	Aggregate sectoral inventory Probably same data system as for determining the target	MRV at installation level with third-party verification
Definition and recognition of trading units	Not applicable at national level	Political decision, not a matter of technical capacity
Setting installation-level targets	Not applicable at national level	Need for installation level data: historical data if based on historic activity, comparison of data if benchmarking
Temporal flexibility	Not applicable at national level	Political decision, not a matter of technical capacity
Registry and transaction log	May be done at international level, otherwise need for institutional and technical capacity	Need for institutional and technical capacity
Market governance	Not applicable at national level	Need for institutional, technical and enforcement capacity
Private sector participation	Not applicable at national level	Need for clear accountability and responsibility for reductions and benefits

Nevertheless, lead times can be expected to be considerable. Butzengeiger-Geyer et al. (2010) consider that national implementation even for government-level schemes is likely to take at least 3 years. If implementation were to be done on an installation basis, national implementation would in their view require an additional 1-2 years.

The examples of Mexico and China highlight the obstacles that are faced even by more advanced developing countries. While Mexico's MRV capacity is relatively advanced, the power and petroleum sectors are dominated by state-owned monopolies, which renders an installation-based ETS impractical. By the same token, however, a government-level scheme might work well as the government has direct control of the emission sources.

China has similar sectoral characteristics, here as well the major companies are state-owned. In addition, the capacity to adequately MRV the individual emitting entities remains very limited. Observers are therefore sceptical whether China's ambitious announcements on emissions trading will indeed be implemented as quickly as planned. Reklev (2011c) notes that even a small market by 2015 would be seen as a success by many. Han et al. (2012) similarly find that "China has em-

barked on a sincere and ambitious attempt to develop a domestic carbon trading system, but that the plans to have a functional national system in place by 2015 are extremely bold and face considerable difficulties."

Substantial capacity building activities such as the Partnership for Market Readiness are already underway. However, pinpointing requirements in detail is difficult as long as the UNFCCC has not defined detailed modalities and procedures for new mechanisms. And while it was decided in Durban to develop these modalities and procedures by the end of this year, given the political divisions on this issue it remains to be seen whether progress will indeed be that fast. To move the process forward it may therefore be useful to consider promoting pilot activities similar to the Activities Implemented Jointly (AIJ) pilot phase launched at COP1 and the REDD+ demonstration activities that were encouraged at COP 13.

Several of the submissions do in fact propose pilot phases for new market mechanisms. For example, AOSIS proposed that the COP or SBI could invite interested developing countries to identify sectors they may wish to propose for participation in sectoral trading or crediting and to invite developing countries to propose emission targets for these sectors, supported by historical inventory information that is capable of review by technical experts. AOSIS notes that such an "early start" could also assist in improving inventory systems, which would also contribute to the biennial update reporting process that was established in Durban. In addition to these practical benefits, inviting developing countries to such a trial period could also be very useful to further determine the degree of interest developing countries actually have in using new mechanisms.

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