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Ambitious New Market Mechanisms

Exploring Frameworks for Pilots

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Summary

In this paper, we analyse how sectoral crediting, as one possible new market mechanism (NMM), can be designed in order to contribute to net mitigation effects beyond offsetting. The paper derives questions and issues which should be explored in pilot projects for NMMs.

We assess four different design options / methods to implement environmental ambition in a sectoral crediting scheme.

- **Discounting**: Credits are generated immediately below BAU, but for each ton reduced only x% of credits are issued
- **Dynamic Discounting**: The discounting rate is increased over time (e.g. x% per year)
- **Ambitious Crediting Baseline**: Credits are generated only if emissions are below a baseline well below BAU
- **Dynamic Baseline Adjustment**: The crediting baseline is adjusted based on previous (e.g. last years) emission reductions.

Under the assumption that the credit revenue would be the key incentive for mitigation actions in a sectoral crediting scheme, the methods show differences in how they would incentivise environmental ambition. The most important findings are:

- Discounting schemes offer the benefit of rewarding mitigation actions from the first ton saved. This makes them a good instrument to "get started". With a dynamic discounting approach, it becomes possible to specifically reward early action. However, these methods are less suitable to move to high ambition as mitigation actions with higher costs may become unprofitable sooner than in e.g. an ambitious baseline approach.
- With ambitious baselines, the environmental ambition of a crediting scheme can be defined ex-ante. Thus, this approach is suitable to develop incentive schemes which are consistent with the atmospheric requirements. If the baseline is well-defined, developing countries could be stimulated to reduce their emissions as they would receive credits once the baseline is reached. Yet if the baseline is (perceived as) unrealistically ambitious, the crediting mechanism would not incentivise any emission reduction at all. Introducing dynamic baseline adjustments may help to develop a learning mechanism and partly compensate insecurities of historic emission data and projections.

Currently several institutions are supporting the development of pilot projects for new market mechanisms and specifically crediting schemes. It will be important in the design of these pilots to test how NMMs like sectoral crediting can effectively support the goal of net emission reductions beyond offsetting. In this respect it would be prudent to analyse whether any of the methods for environmental ambition would also be more suitable to one (sub-) sector or the other.

A key challenge in successfully implementing any ambitious sectoral crediting scheme will be to balance the environmental ambition correctly – to avoid windfall profits by too low ambition, but not risking inaction by raising the bar too high. Obviously, availability of good data in the host country would be a prerequisite to define an adequate ambition level (BAU emission trajectories, mitigation cost estimates, etc.). However, it should be assessed whether the sensitivity to limited availability of data is equal in all of the four methods for ambitiousness. Especially in the early phases of sectoral crediting implementation, it will be necessary to readjust the level of ambition, based on achieved emission reductions, newly available data and general experiences with the mechanism.

1 Introduction

The key design challenge of the new market mechanism is at the same time what sets it apart from existing CDM and JI measures: the goal of the new mechanism is to "stimulat[e] mitigation across broad segments of the economy" and to "ensur[e] a net global decrease and/or avoidance of global greenhouse gas emissions", as agreed at COP 16 in Cancun (UNFCCC 2011).

The latter aim - net decrease and/or avoidance of GHG emissions - represents a crucial departure from the existing project-based crediting mechanisms, which are focused entirely on the offsetting of emissions (Prag / Briner 2012). Yet, it is not clear how such 'environmental ambition' would best be implemented in the design of a new market mechanism.

The broader scale of the NMM suggests a sectoral approach that transcends the individual installation level and focuses instead on the emission performance of entire sectors or larger segments of an economy. Four 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 (see also Sterk 2011).

The decisions adopted at COP17 in Durban and COP 18 in Doha do not explicitly state whether the new market mechanism should be based on a system of emissions trading where allowance units are issued ex ante, or whether to design a crediting mechanism where credits are awarded ex post if measured emissions are below a baseline level. In line with the aim of

		What	Proposed by
Project Based	Individual Performance Approach	Similar to CDM and JI	China, Japan
Sectoral Crediting	Group Performance Approach	Decoupled from specific activities, credits are awarded if emissions from sector are kept below a pre-defined level	EU, AOSIS, Norway, Papua New Guinea
Sectoral Trading	Group Performance Approach	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	Group or Individual Performance Approach	Crediting of specific NAMAs or based on sectoral thresholds	South Korea (Switzerland)

Table 1-1: Types of proposed new mechanisms. *Source: Adapted from (Sterk / Mersmann 2012 p.4).*

"assisting developed country Parties to meet part of their mitigation targets" (UNFCCC 2011) as stated in the Cancun Principles, and considering the limited scope of this paper, the following chapters will focus on the design of a sectoral crediting mechanism. Moreover, some authors suggest that the new market mechanism would be simplest to implement as a crediting mechanism given the provisions contained in its definition (see Prag / Briner 2012). Nevertheless, national governments may well implement domestic emissions trading systems operating in parallel with a new market crediting mechanism (see section 2.3).

In parallel to the negotiation track, some stakeholders have set out to explore different design options for NMM by ground testing. We anticipate that NMM "pilot" projects will be implemented within the next years and will provide learning on how to design the overall UNFCCC framework. It will be important in the design of these pilots to test how NMMs like sectoral crediting can effectively support the goal of net emission reductions beyond offsetting.

How to read this paper

It is the intention of this paper to give a structured overview of possible design options for sectoral crediting in order to contribute to a net decrease or avoidance of GHG emissions. From this theoretical analysis of concepts for environmental ambition, key questions and issues, to be explored further in pilot projects for NMMs, are derived.

As there are many design options for new market mechanisms and the topic is very complex, chapter 2 starts out with a recap of key features of sectoral crediting:

A) section 2.1 describes two possible approaches of calculating the number of credits to be issued: a) the individual performance approach, and b) the group performance approach.

B) BAU scenario definition and baseline setting is a key issue in sectoral crediting, which is discussed in section2.2.

C) In many cases, credits issued in a sectoral crediting mechanism may not go to market actors but through the government. Options for such a national implementation are briefly sketched in section 2.3.

If you are an expert in this field, you may want to jump directly to chapter 3, which spells out different options of how to implement environmental ambitiousness in the design of sectoral crediting. Sections 3.1 to 3.5 sketch supply side options while section 3.6 briefly addresses demand side discounting of credits, which will not be elaborated further in this document. Section 3.7 draws comparisons between the different approaches and section 3.8 extends the view beyond one single crediting period and discusses incentives for investors based on anticipations for future crediting periods.

Chapter 4.1 looks at the implications of the negotiation process on the design options for sectoral crediting. Chapter 4.2 summarises the status of the UNFCCC negotiation on new market mechanisms and highlights the issue of double counting for designing an environmentally ambitious sectoral crediting mechanism.

In chapter 5 key findings are summarised and conclusions for the development of pilots for new market mechanisms are drawn.

2 Fundamental design options for sectoral crediting

2.1 Group versus individual performance approach

One key feature of CDM and JI is that credits are issued based on the individual performance of one project / one installation – irrespectively of the performance of all other installations in this sector. To receive credits, the additionality of a mitigation action must be proven or a standardised baseline is set-up as a benchmark. Any installation with emissions below the baseline receives credits (as shown in Figure 2.1).

In contrast, group performance approaches assess the emissions of a whole sector or group of emitters. Credits are issued based on the performance of the whole group / sector (as shown in Figure 2.2). This could be done by e.g. 1) comparing the mean performance of the group with a certain benchmark or 2) by defining a total maximum emission baseline for the whole sector. This implies that high emissions of heavy polluters might partly balance off or even overcompensate emission reductions achieved by cleaner installations.

Comparing these two approaches, the following key issues are important:

- Number of credits: Everything else being equal, fewer credits are issued in a group performance approach. In return this means that to reach the same level of environmental integrity / ambition, the baseline in an individual performance approach needs to be set lower accordingly.
- Distribution of credits: Unless the group members are subjected to binding obligations, there will probably be good and bad performers. Hence, the number of credits available for the whole group in a group performance approach is less than the credits "earned" by the good performers. Directly distributing credits therefore works only if some institution (the government) covers for the mismatch or if the distribution

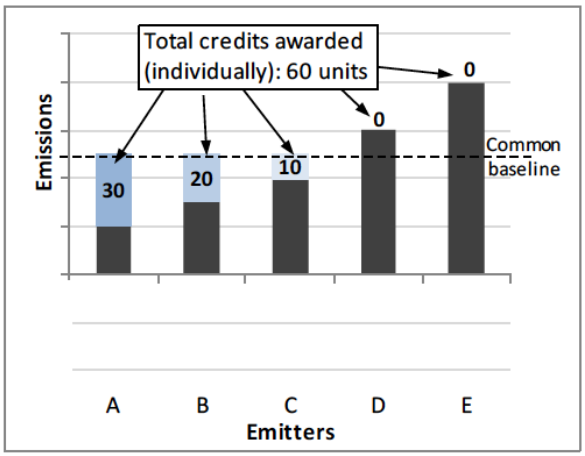

Figure 2.1: Crediting according to individual performances approach. *Source: (Prag / Briner 2012): 21*

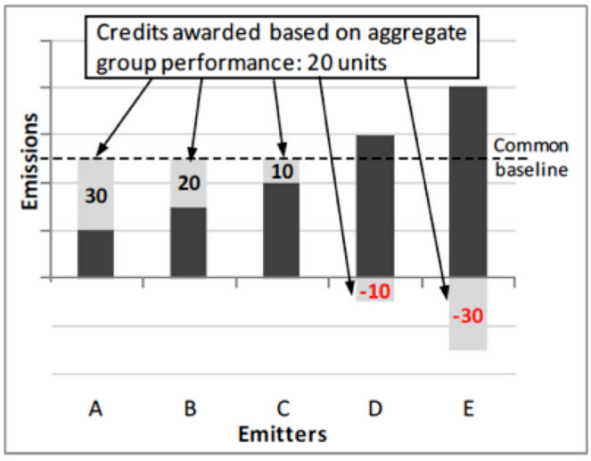

Figure 2.2: Crediting according to group performance approach. *Source: (Prag / Briner 2012): 21*

scheme is different from the credit generating scheme (Compare example in Figure 2.2: here a total of 20 credits would need to be distributed among 3 installations who have reduced emissions worth 60 credits).

To summarise, project based mechanisms like CDM are based on individual performance . Sectoral mechanisms like sectoral crediting are generally based on group performance . One important issue here is how the credits gained for the emission reductions achieved by the whole sector are distributed among installations in the sector (if at all). Options for distribution schemes are sketched out in section 2.3.

For all group based approaches, different options to set baselines exist, which will be discussed in the next section.

2.2 Baseline setting and accounting in Sectoral Crediting

The general concept of sectoral crediting is that countries agree on a "no-lose target", that is a level of emissions for a sector. The developing country receives credits if emissions are reduced below the target. If the target is not reached, there are no penalties.

Thus, sectoral crediting follows a group performance approach – the number of credits received depends on the performance of the whole sector.1 Nevertheless, the accounting to determine the number of credits to be issued could be done by using two different methods:

Installation-level accounting: Measuring individual emissions of installations and assessing these against a standardised baseline (e.g. based on performance of low-carbon technology option in this sector) this option equals the concept displayed in Figure 2.2, p.3.

Aggregate sectoral accounting: Measuring the total emissions of a sector / group of installations and assessing the total against a crediting baseline for the whole group or sector (see Figure 2.3).

Given that all installations of a sector are covered, both methods would yield the same result. However, the practical applicability varies from sector to sector: In a sector with similar and relatively large emitters (e.g. power sector or certain industries) approaches a) and b) would factually be quite similar in terms of effort and process. In highly fragmented sectors (e.g. transport) it would be impractical to measure emissions at the emitter level. Instead emissions can be calculated based on fuel consumption, which can be measured at an aggregated level.

In the following we will focus on the aggregate sectoral approach. In our view it represents better the large-scale thinking, which is aimed at with sectoral mechanisms and is more appropriate specifically for those sectors which have been neglected in the CDM so far. However, this is not to say that installation-level accounting setting may not be a suitable approach for specific (sub-)sectors. The reason why we exemplify our analysis along the concept of aggregate sectoral accounting is that we consider this perspective to be more holistic and appropriate for a wider range of mitigation actions and sectors.

[1] Some proposals for implementation schemes of sectoral crediting (see section 2.3) foresee to initially distribute credits based on individual performance. But then some actor, usually the government, would have to cover a possible mismatch between the individual performance and the sector performance. (IETA 2010)

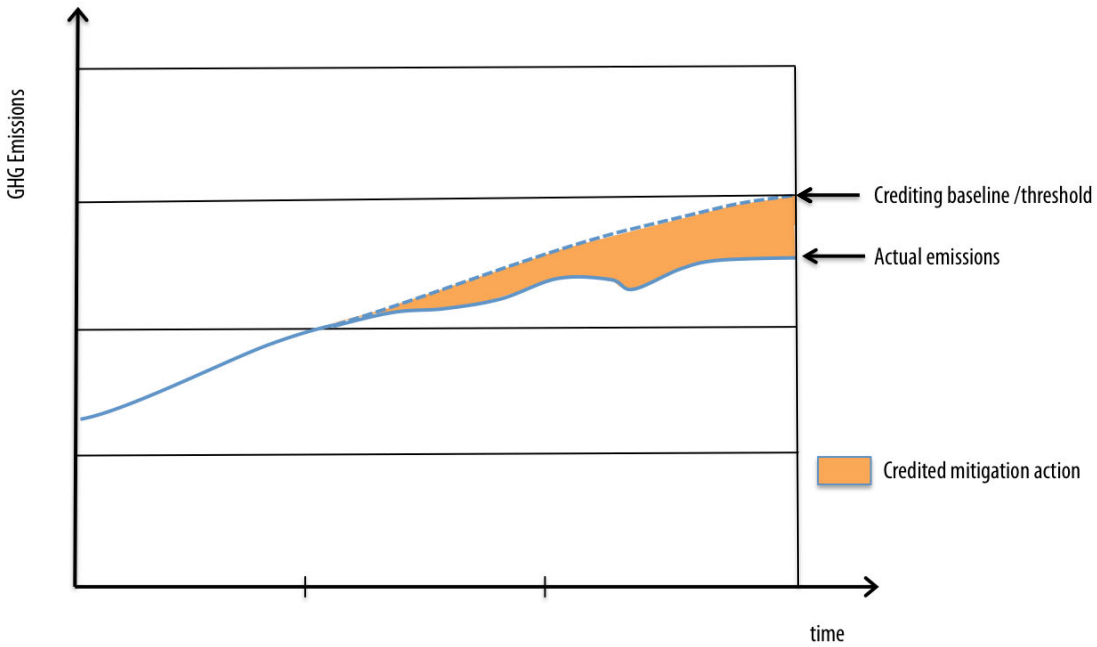

Figure 2.3: Sectorial crediting – concept. *Source: Graph by Wuppertal Institute based on (Schneider / Cames 2009).*

Absolute vs. indexed baselines

Furthermore, different types of baselines could be chosen: absolute baselines (GHG emissions), indexed baselines (e.g. with physical metrics like kWh produced or economic metrics like GDP, products or services provided by the sector) or technology penetration baselines. Indexed baselines have the advantage that it is easier to filter out the success of mitigation actions in contrast to other effects which influence the overall emissions (e.g. population and economic growth). Many developing countries have favoured indexed baselines as they allow more possibilities for activity growth. In contrast, absolute baselines provide certainty on the environmental outcome, which indexed baselines do not. Furthermore, they are better suited for system approaches, which integrate mitigation actions addressing both energy supply and demand (e.g. an indexed baseline in the power sector with an index of CO2/kWh would incentivise low-carbon power production but would not reward demand side management activities.

Referring to the two methods of emission accounting above – installation-level and aggregate sectoral – it is important to note that both methods are well fit to assess the performance of an emission index (e.g. emissions/GDP). However, it is difficult to use installation-level accounting to assess performance against a sectoral target of absolute emission reductions: The benchmark is the performance of an individual installation. But additional (newly built) installations would factually increase total emissions even if the they are well below the benchmark. The sectoral target would therefore need to include a reserve for new installations, the appropriate size of which may be difficult to estimate.

Difficulties in defining a baseline

Defining an appropriate crediting baseline is a very difficult task – both from a technical and a political perspective. How to define additionality and baselines in the CDM has been and continues to be a major field of discussion. For sectoral mechanisms most approaches to define a crediting baseline use a business as usual (BAU) scenario of GHG emission devel-

opment as a reference. Developing such BAUs is dependent on many assumptions and methodological questions. Beyond (technical) questions of uncertainty of future predictions, there is the obvious difficulty that countries participating in a sectoral scheme have an interest to inflate their future emission projections in order to maximise their credit revenue from the mechanism. For a detailed analysis of difficulties in baseline definitions for sectoral crediting see (Schneider / Cames 2009).

2.3 National implementation schemes

New sectoral mechanisms would probably 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. 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. However, the responsibility for meeting the targets would stay with the host governments. This is a significant difference to the current project-based mechanisms, where the liability for project failures lies solely in the hands of private project developers. New market mechanisms would give host governments a much more active role in safeguarding greenhouse gas reduction achievements (Butzengeiger et al. 2012).

On this basis, the following basic options can be conceived (Sterk and Mersmann 2012):

A) The government sets a voluntary sectoral baseline and implements non-ETS (Emissions Trading System) policies and measures to reduce emissions. These may be either mandatory "sticks" or voluntary "carrots". At the end of the crediting period, the government receives credits according to the overall sector performance. It may use these credits at its own discretion to cover (part of) the costs caused by the mitigation actions.

B) The government sets a voluntary sectoral baseline 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. However, at the end of the crediting period, the government receives credits according to the overall sector performance. Thus, the installation baselines need to be set low enough to cover for those installations that do not beat the baseline – or the government has to cover for the mismatch by buying credits on the international market.

C) The government sets a voluntary sectoral baseline and defines binding installation-level emission targets, possibly forming the basis for a national ETS. At the end of the crediting period, the government receives credits according to the overall sector performance. With these it can cover (parts of) the costs of the ETS and may distribute (part of) the credits among ETS participants.

International handling of credits / emission units	Government receives credits/allowances			D) Installation receives credits
National implementation	A) Government policies	B) Installation-level crediting	C) Binding Installation rgets	

Figure 2.4: Options for implementation at government or installation level. *Source: Wuppertal Institute.*

D) The International Emissions Trading Association (IETA 2010) has 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. However, the national government would have to cover the mismatch between credits allocated and a possible lower performance of the whole sector.

These different options are illustrated in Figure 2.4. 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.

3 Ambitiousness in sectoral crediting

A sectoral crediting mechanism should be designed to be both broad in scope and to ensure a net decrease or avoidance of global GHG emissions. In this section we describe different methods to design an environmentally ambitious sectoral crediting mechanism, which would allow to achieve a tangible environmental benefit with a view to reducing global GHG emissions rather than to merely offset emissions. Based on an assessment of approaches described in the literature on NMMs and CDM (see also (Baron et al. 2009; Füssler 2012; Kollmuss, Anja et al. 2010; Prag / Briner 2012 and Schneider 2008)[2]), we define four basic variants for environmental ambition in sectoral crediting:

1. Ambitious Crediting Baseline
2. Discounting
3. Dynamic Discounting
4. Dynamic Baseline Adjustment

These four models are discussed in the following sections. Additionally the concept of shorter crediting periods, which is being discussed for project-based mechanisms, is discussed with respect to transferability to a sectoral approach.

All of the approaches analysed in more detail aim at the supply side of credit generation. It would also be possible to increase environmental ambition at the demand side (e.g. by discounting credits when buying them). However, in doing so we see the risk of a fragmentation of carbon markets. Consequently we briefly sketch the concept of demand-side discounting in section 3.6 but will not go into detail on this option.

[2] (Schneider 2008) analyses options to promote atmospheric benefits into the CDM, as well as the pros and cons of these different options. The options are similar for NMM. However, the implications, pros and cons are significantly different.

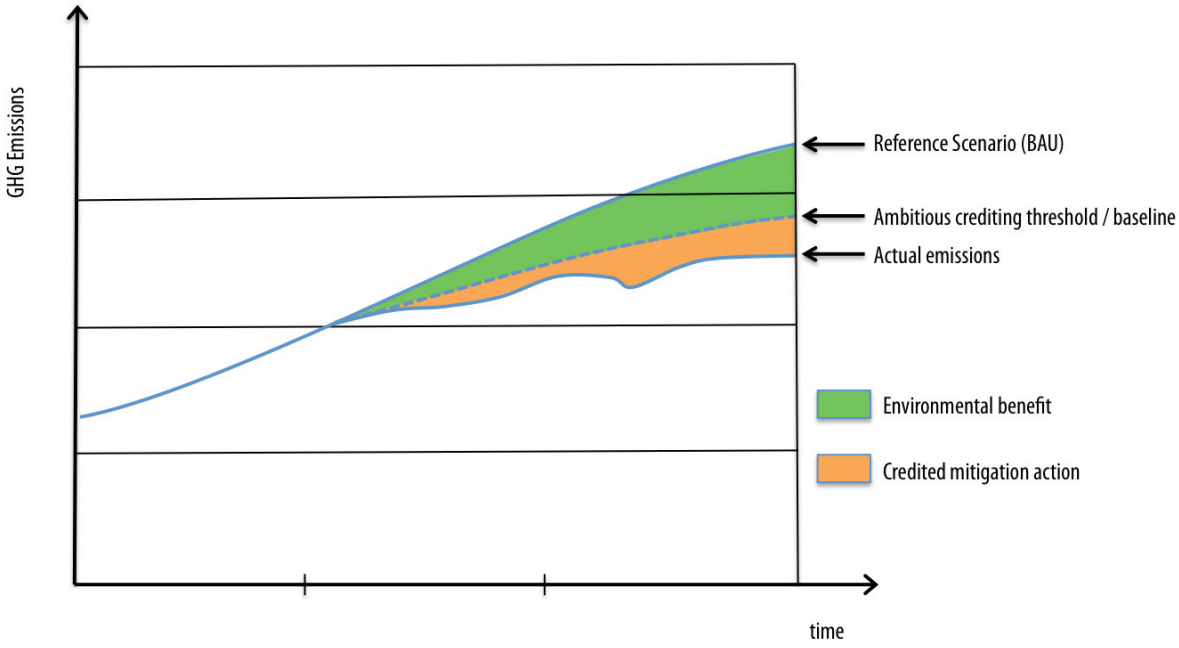

Figure 3.1: Setting an ambitious crediting baseline. *Source: Graph by Wuppertal Institute based on (Schneider / Cames 2009)*

3.1 Ambitious baselines below BAU

One approach to achieve a net decrease or avoidance of emissions is the definition of ambitious baselines that limit the issuance of credits solely to mitigation actions achieved in excess of national mitigation efforts in developing countries (see figure 3.1). In this sense, crediting thresholds are considered 'ambitious' if they are set well below BAU reference baselines and allow for a specified level of non-credited mitigation. Credits for international trading are issued only if emissions are reduced below the ambitious baseline. Ambitious crediting thresholds can be based on assumptions of demand growth and on factors of best available technology, or based on performance benchmarks corresponding to the average performance of e.g. the top 10% of the group (similar to EU-ETS benchmarking) (see (Füssler 2012; Prag / Briner 2012).

The non-credited emission reductions will come from unilateral or supported NAMAs. We generally assume that a country would preferably choose low-cost solutions for these NAMAs, as indicated in the MAC curve of Figure 3.2, while additional activities with higher costs would be remunerated through credits. Some of these actions could yield a net profit, which could be used by the government to remove barriers to low-cost actions.[3] Mitigation actions with costs higher than the market price for credits would only receive partial funding through the carbon market. Consequently the incentives to implement such actions are low.

[3] It has to be pointed out that MAC assessments take a business perspective. But obviously other barriers in addition to costs exist, which lead to the fact that negative-cost mitigation potential exists at all. Many of these barriers can be lowered or removed by governments (e.g. providing information, regulatory frameworks, securing loans) but generally this comes at some cost for the government.

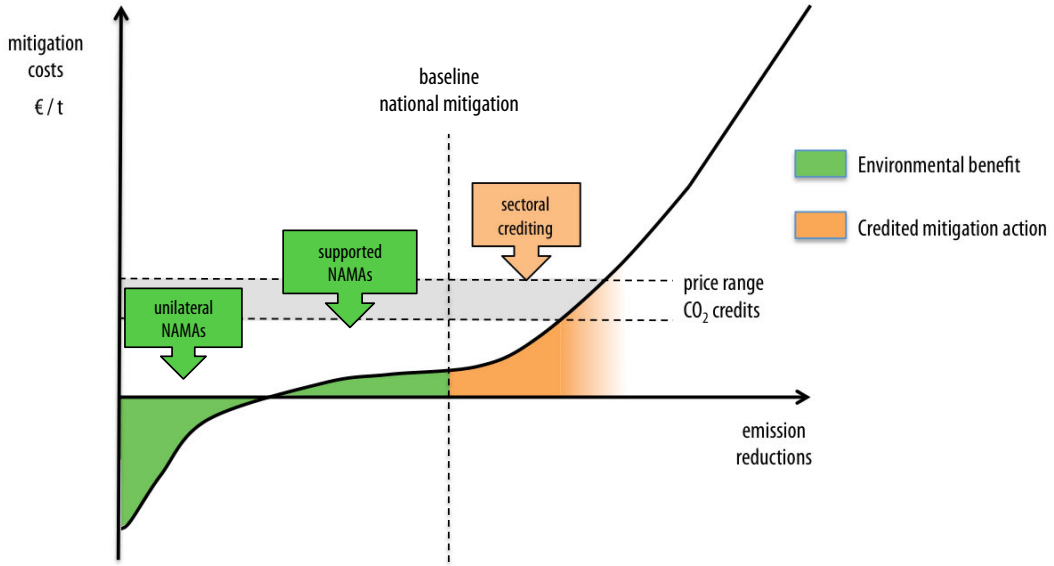

Figure 3.2: Sectoral Crediting in Marginal Abatement Cost Curve. *Source: Graph by Wuppertal Institute based on (Wehner et al. 2010).*

As described in section 2.3, in most implementation schemes the credits would first go to the government and then may (or may not depending on the scheme) be distributed to market actors. A government may choose to implement actions which are only partially funded through the carbon market (e.g. for strategic reasons or because of co-benefits). But generally speaking, if we assume that the prospect of receiving credits is the key incentive for governments to implement mitigation actions under a sectoral crediting mechanism – we must in return assume that it is unlikely that governments would implement actions with costs higher then the return gained by selling the credits.

Consequently, in setting the crediting baseline / threshold one needs to strike a balance: an unambitious baseline will yield little net GHG emission reduction and may even lead to windfall profits for mitigation actions the country would have done anyhow (e.g. for other than mitigation reasons). A too ambitious baseline would be a barrier to significant mitigation success: if reaching the baseline seems unrealistic, then there is no incentive for enhanced mitigation. In the worst case, a too ambitious baseline could lead to untapped potentials of low-cost solutions.

3.2 Discounting of emission reductions

In this approach, host countries receive only a share (percentage) of credits for a certain achieved emission reduction, while a percentage of credits is cancelled to ensure an environmental benefit (see Figure 3.3). The percentage value needs to be fixed ex-ante together with a reference scenario of emission development (BAU).

Any emission reduction below the BAU reference scenario generates credits (and not only after the ambitious baseline is surpassed). Thus, mitigation immediately "pays off", which may serve as a strong incentive to start implementing the respective measures and actions straight away. However, the extent of the achieved environmental benefit depends

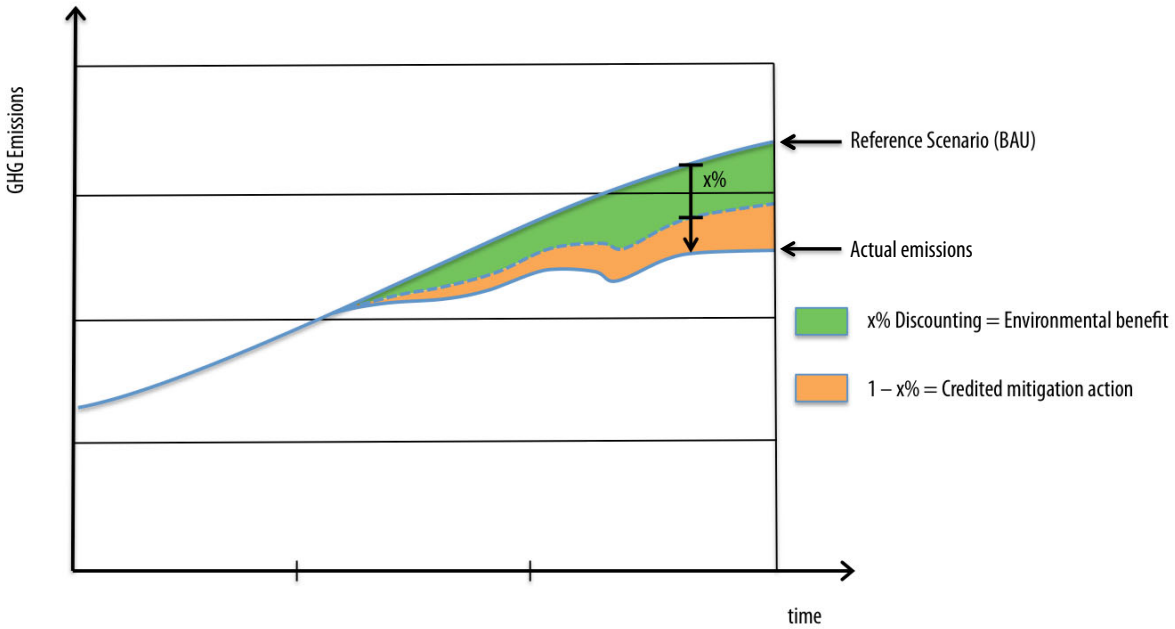

Figure 3.3: Discounting of emission reductions. *Source: Graph by Wuppertal Institute based on (Schneider / Cames 2009).*

directly on the total emission reduction achieved.[4]

However, in comparison to the ambitious baseline approach, it seems to be more difficult to incentivise strong environmental ambition: The higher the environmental ambition is, the smaller this share needs to be (to be negotiated beforehand). Assuming a carbon price of 20,- € per ton and an ambition ratio of 50%, the country would receive 10,- € for every ton saved below BAU. This leads to a windfall profit for mitigation actions with costs below 10,-€. In contrast, any mitigation action with costs higher than 10,- € would lead to a deficit for the country. It can be argued that higher discounting rates lead to fewer available emission reduction credits and consequently to a higher carbon price (Schneider 2008), but this does not solve the fundamental problem of the discounting scheme as compared to setting baselines below BAU. If we compare the two approaches (ambitious baseline vs. discounting) in the case where

- the environmental ambition is equal, (thus the green area is equal in Figure 3.1 and Figure 3.3)
- and the credits generated are equal, (thus the orange area is equal in Figure 3.1 and 3.3)

then we can assume that the marginal carbon price for further mitigation would be equal. The accumulated costs and revenues are equal in both systems (assuming the same level of GHG emissions), as in the discounting case windfall profits for cheap mitigation actions balance off shortfalls in revenues for costly actions. A government with high environmental ambition may choose to look only at the total balance and extend their mitigation efforts into actions where the carbon price does not cover the full mitigation cost. But less ambitious governments and private actors would most likely choose to maximise their profit and stop as

[4] To illustrate this: The environmental benefit is x% of the emission reduction below BAU (this could be x% of 1 ton or x% of 4 million tons or any other number) – and independently of the environmental benefit, credits are rewarded (1-x% of emissions reduced). In contrast, with the ambitious baseline method, the environmental benefit is fixed to y tons. Of course the emissions reduction could also be lower – but then, no credits would be issued at all.

soon as the return for investment of the individual action becomes negative.

The impact varies within the different options for distributing the credits (see national implementation schemes, in section 2.3). The more directly private investors receive credits, the less fit a discounting scheme is to incentivise high environmental ambition. In national implementation schemes with high public involvement, high ambition may be possible – but is depending on the political will of the government. In any case the incentive for high ambition is lower than in an ambitious baseline approach.

3.3 Dynamic Discounting

One variant of discounting is to introduce a dynamic discounting function: e.g. in the first year 100% of the reduced emissions receive credits, in the second year only (100 – x)%, then (100-2x)% and so on (see Figure 3.4).

We see two advantages in this approach:

- It rewards early action, since the number of credits earned per emission reduction is higher the earlier mitigation actions are implemented.
- It would allow a gradual shift from a full crediting scheme to a partial crediting scheme, which may be diplomatically interesting for developing countries.

The approach requires a clear-cut timely assessment of emissions, e.g. every year, which is reasonable with respect to MRV requirements and should be also in the investors' interest to receive return on investment timely.

3.4 Shorter crediting periods

In the CDM introducing shorter crediting periods is one option to introduce environmental ambition (Cames 2009). In this approach the period in which a mitigation action is awarded credits would be shorter than the lifetime of the mitigation action. That is, credits would be issued for e.g. the first five years of a project estimated to generate emission reductions over fifteen years. During the remaining ten years of the project no credits would be issued to en-

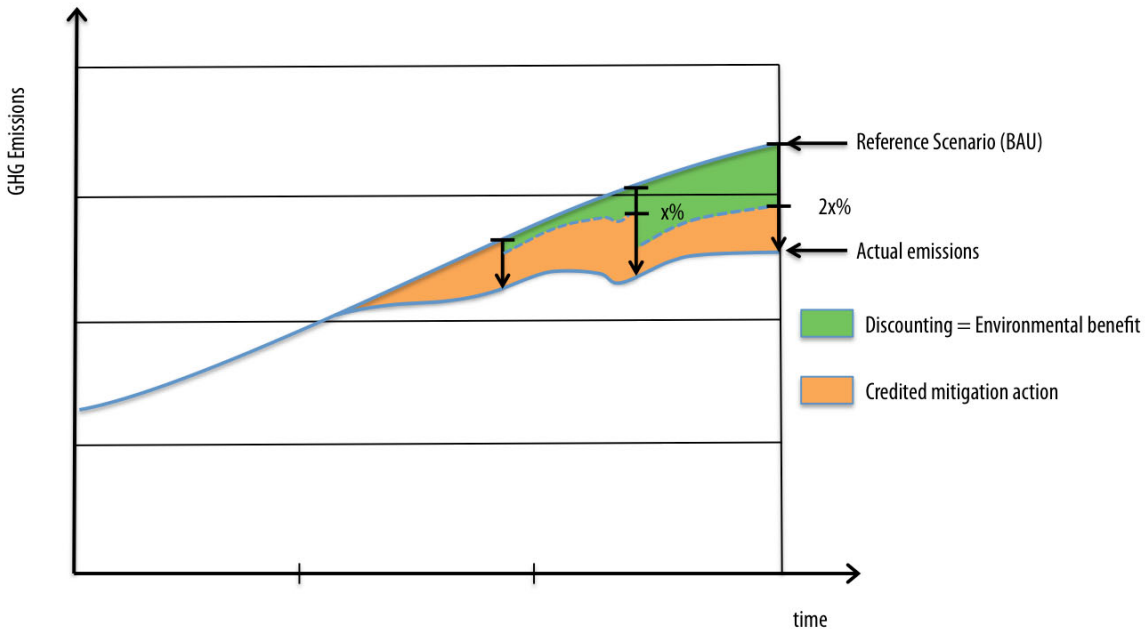

Figure 3.4: Dynamic Discounting – yearly increase of discount rate. *Source: Graph by Wuppertal Institute based on (Schneider / Cames 2009).*

sure an environmental benefit.

This approach seems easy to implement within project based mechanisms, where "lifetime" can easily be defined based on a standardised lifetime of the technology used. Thus a switch from a technology A (current standard in country) to technology A+ would then be awarded with e.g. 5 years of credits, although the technology's lifetime would be higher. However, in order to ensure a true environmental benefit, the definition of appropriate technology baselines and lifetimes is crucial. To be ambitious, the baseline should refer to the average of newly installed technologies (and not to the features of existing technologies). The crediting period would need to take into account possible future developments: a few years down the road technology A+ may be the new standard. If credits are generated beyond this time, the environmental benefit may be much smaller than anticipated, or even negative.

Within a sectoral mechanism, there are fundamental problems, which make this approach very difficult to implement:

- Definition of lifetime: Mitigation actions within a sectoral mechanism would generally encompass a variety of technologies with possibly very different lifetimes. A very homogeneous (sub-) sector with a very limited number of possible actions would be needed to reasonably define one lifetime for the whole (sub-) sector.
- Crediting period: In sectoral crediting the mitigation effect of many different activities is aggregated in the assessment of GHG emission reductions. Actions that are triggered by the sectoral scheme may start any time.

Due to these difficulties, our assessment is that shorter crediting periods, which are an option for project-based mechanisms, are impractical for sectoral mechanism and will not be considered further. It is however possible to adapt the concept, which lead us to the development of a dynamic baseline adjustment approach.

3.5 Dynamic baseline adjustment

The concept of dynamic baseline adjustment builds upon the approach of shorter crediting periods for project based mechanisms, but is adapted to a truly sectoral approach: Credits could be generated as soon as emissions are below BAU (or a pre-defined ambitious baseline as described in section 3.1). After a relatively short crediting period the crediting baseline would be lowered by a share of the emission reductions achieved. Consequently the credits generated would decrease and in return the environmental benefit would increase over time (see Figure 3.5).

This approach would require shorter intervals for the (internal) national reporting. However, the measurement effort would be equal (the total sum of GHG emissions needs to be measured anyhow). With a reporting / crediting period of one year, this effort should be reasonable. However, it is important that date on historic emissions is collected and published quite rapidly.

Generally the approach shows quite similar features as the discounting approach: Mitigation pays off immediately. Credits are issued starting with the first ton of emission reduction. But since emission reductions lead to an adjustment of the baseline, only a fraction of the emission reduction is transferred into credits, which in total equals a reduced carbon price for all actions, as described in section 3.2)

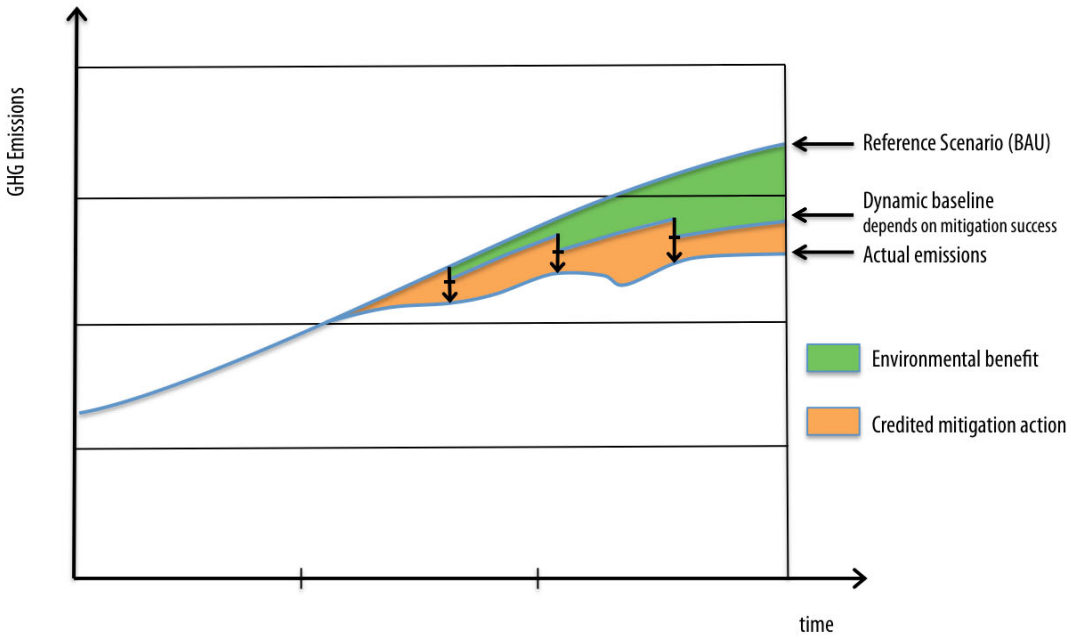

Figure 3.5: Dynamic baseline adjustment. *Source: Graph by Wuppertal Institute based on (Schneider / Cames 2009).*

In the case of a too high (inflated) BAU scenario, the resulting "virtual" emission reductions would lead to an adjustment of the crediting baseline. Thus, one advantage of this approach is that the negative effect of a too high BAU scenario would be partially compensated.

A disadvantage of the approach would be that the predictability of future baselines is limited (as it is a variable of achieved emission reductions). The impact of this on investment decisions strongly depends on the national implementation scheme (see section 2.3) as some schemes foresee a strong government involvement. Thus, disbursement for mitigation actions may not directly depend on the revenue from credits.

In sectors where decreasing mitigation costs can be anticipated (e.g. renewable energies like wind and PV have shown massive decreases in costs per kWh or tCO_{2eq} respectively), investors generally (in all crediting schemes) may gain more credits per dollar of investment if they wait for mitigation costs to go down further. However, in a scheme with dynamic discounting this effect could be even stronger. Early action does not only yield a lower return on investment, compared to later investment – but also leads to a more ambitious baseline in the future. This could be perceived a double punishment for early actions. Therefore, we consider this approach not suitable for sectors with strongly decreasing mitigation costs.

3.6 Demand side discounting

All of the above methods aim at introducing environmental ambition at the supply side of credits – thus reducing the number of credits received per ton of emission reduction achieved. A fundamentally different option would be to increase ambition at the demand side – in buyer countries, e.g. the EU ETS rules could be set up so that 1+x credits are to be bought for one ton of emissions to be offset.

It is important to note that any type of discounting (supply and demand side) translates 1+x tons of emission reductions in a developing country into 1 ton of emissions which can be offset in a buyer country. The only difference is

that the tradeable credits are either equal 1 ton in the seller country (demand-side discounting) or in the buyer country (supply-side discounting). Consequently, our assessments with respect to supply side discounting also hold true for demand side discounting.

However, major differences arise as soon as different levels for ambition are to be set for different countries / country groups. One may argue that the concept of common but differentiated responsibilities would imply that credits from richer countries (e.g. emerging economies) should be discounted more strongly than those from poorer countries (e.g. least developed countries). This, however, would lead to different market prices for credits from different countries and would make trading more complex.

Additionally, it would be necessary to agree on common discounting factors for any buyer countries who intend to link their carbon market (e.g. if EU ETS discounts certain credits by 50%, but Australia would not, then it would economically be favourable to buy Australian allowances – which again could be offset by one credit). Otherwise the linkage would factually introduce the weakest discounting factor for the whole system (unless other strong restrictions are introduced). The linking of carbon markets in developing countries would be even more complicated, as they may want to choose to introduce a carbon market in one sector, but prefer a crediting scheme in another sector but would allow for internal offsetting.

Any of the above describe methods for environmental ambition could be combined with additional demand-side discounting – however, at the risk of fragmenting the carbon market.

Within this paper we will not go further into aspects of demand side discounting.

Name of Method	Short Description	Pro	Con
Ambitious Crediting Baseline	Credits are generated only if emissions are below a baseline well below BAU	Level of ambition / environmental benefit can be defined ex ante.	If baseline is too ambitious ("unreachable"), incentives to even start mitigation is low.
Discounting	Credits are generated immediately below BAU, but for each ton reduced only x% of credits are issued	Any mitigation effort is rewarded with credits from the beginning	High ambition is not incentivised as discounted credits may be less likely to cover costs of ambitious mitigation actions
Dynamic Discounting	The discounting rate is increased over time (e.g. x% per year)	Rewards early action since full credits are gained in the beginning	Higher MRV requirements through frequent (e.g. annual) assessments of emission reductions
Dynamic Baseline Adjustment	The crediting baseline is adjusted based on previous (e.g. last year's) emission reductions.	Partly compensates for inflated BAU scenarios	Higher MRV requirements as past sector performance defines future baselines

Table 3.1: Overview of methods to ensure environmental ambition.

3.7 Comparison of methods

In comparing the four methods to introduce environmental ambition in sectoral crediting (see Table 3-1), we find that discounting approaches are less fit to move to high levels of ambition. Their advantage is to reward mitigation action from the beginning. In a dynamic discounting scheme early action is especially incentivised. The method of setting an ambitious crediting baseline is well fit to define the environmental ambition ex-ante. But in a way it carries some "all or nothing" risk: a too ambitious baseline may lead to reluctance to even start implementing effective mitigation actions.

The practicability of these four methods in specific implementation environments – specific (sub-)sectors in specific countries – is hard to assess on a general level. Consequently we would see the role of pilot projects for new market mechanisms in assessing the practicability of the above described methods with respect to:

- **Matching of sectors with methods**

  From experiences gained in the CDM as well as from conceptual work on NMMs (Bolscher et al. 2012) it is known that the technical details of design options and MRV requirements will have a strong impact on the suitability of a mitigation mechanism for specific sectors. In this respect it would be interesting to analyse whether any of the methods for environmental ambition would also be more applicable to one (sub-) sector over the other.

- **Defining the right level of ambition**

  A key challenge in successfully implementing any ambitious sectoral crediting scheme will be to balance the environmental ambition correctly – to avoid windfall profits by too low ambition, but not risking inaction by raising the bar too high. Obviously, availability of good data in the host country would be a prerequisite to define an adequate ambition level. It needs to be assessed whether all of the four methods for ambitiousness would be equally sensitive to availability of data.

- **Dynamic readjustment of ambition**

  Especially in the early phases of sectoral crediting implementation it will be necessary to readjust the level of ambition, based on achieved emission reductions, newly available data and general experiences with the mechanism (see also section 3.8). Maybe it is even possible to design processes, which are self-adjusting.[5] The dynamic discounting and baseline adjustment methods go into this direction: the emission reduction of the previous assessment period defines the baseline / ambition for the next period.

The whole portfolio of pilot projects for new market mechanisms should thus be set up in a way to address the above issues. Thus it would be interesting to design a variety of pilots, covering all of the four methods to implement environmental ambition (or even additional ones and variants) in different (sub-)sectors in different country types.

3.8 Further crediting periods

So far, we have described one single crediting period and the impacts of different design options within one period. However, it is important to think of what comes after the first crediting period: Depending on what governments and market actors anticipate for the following period, they may take different decisions & investments within the crediting period.

[5] For example the German feed-in tariff has introduced continuous adjustment scheme: based on the installation level of the last assessment period, the feed-in tariff is automatically adjusted (up or down) to provide higher or lower incentives (BMU 2012).

Schneider / Cames (2009) argue that crediting periods should be aligned with commitment periods in order to avoid complex transitional arrangements (due to possible overlaps of different mechanisms, e.g. CDM and a new sectoral mechanism or sectoral mechanisms with more integrated carbon market solutions). Furthermore, they opt against a low-level/automatic renewal procedure at the end of a crediting period and rather prefer a new application, based on an in-depth analysis (e.g. on emission trajectories). The latter would also allow for capable countries to move to more ambitious targets in a timely manner.

Length of crediting periods

Deciding on the length of a crediting period will have major impacts on the effectiveness of a new market mechanism:

- From a policy makers' perspective, shorter crediting periods are favourable in order to allow adjustments to the mechanism based on practical experience. For investors, however, long-term planning is vital. If investors fear stranded assets due to upcoming changes in the mechanism, then they are unlikely to invest in mitigation actions in the first place.
- Furthermore, shorter crediting periods incentivise mitigation actions with short payback periods. Actions with payback periods longer than the crediting period would not be as attractive for the investor – even though they may be more economical over the lifetime of the mitigation action. Thus, short crediting periods incentivise quick win actions but not necessarily least cost solutions.

Cyclical investment over crediting periods

In general, any sectoral crediting scheme risks cyclical investments (Schneider / Cames 2009): investments taken at the beginning of the crediting period can earn more credits for emission reductions compared to actions taken at the end of a crediting period. However, this effect strongly depends on two factors:

- What is the anticipation for the framework after the current crediting period?
- Which national implementation scheme is chosen? / How are credits distributed to market actors?

As discussed above, it will probably be the government who receives the credits initially (and then may or may not distribute them to market actors (see section 2.3). Thus, the government may choose to design its national implementation scheme in a way to incentivise mitigation investments all throughout the crediting period. Obviously, a government would have a strong interest in doing so if it anticipates stricter (environmentally more ambitious) crediting schemes or even other stricter agreements (e.g. commitment to binding targets) after the current crediting period. But governments may also strategically choose to wait if there is uncertainty on future agreements.

In the *installation level crediting* schemes (see Fugire 2.4, schemes B and D) private investors directly receive credits for mitigation success. In these cases investments can be expected to be very low in later stages of the crediting period if the uncertainty of continuation beyond the crediting period is high. In the implementation schemes of government policies (scheme A) or binding installation targets (scheme C) more continuous ambition could be incentivised or regulated by the government.

4 Negotiating new market mechanisms

4.1 Negotiating a sectoral crediting mechanism

To assess the different option for sectoral crediting, it is important to consider the different options how sectoral mechanisms could be negotiated at the UNFCCC level.

The most critical issue in all of the above options is setting the level of environmental ambition – too little ambition will create windfall profits for actions with limited environmental benefit; too high ambition would generally result in too low return on investment and would thus turn a market mechanism ineffective due to too little participation. Thus environmental ambition must be carefully balanced, through defining:

1. **A stringent BAU emission trajectory**

   A BAU scenario is a prerequisite for all sectoral crediting scheme options. International criteria or review processes may be implemented. Nevertheless emission trajectories must be defined country by country.

2. **The respective levers for environmental ambition (ambitious baseline, discounting rate etc.)**

   Those levers could in principle be defined globally for all countries or for different country groups. They could be different for specific (sub-)sectors or could be fully tailor-made (different percentages for each (sub-)sector in each country).

On the second issue, it may seem logical that for each country and each (sub-)sector targets/levers for environmental ambition would be negotiated individually. However, this would entail a very complex process depending on the number of (sub-)sectors which are to be negotiated simultaneously since the negotiated ambition level in one (sub-)sector may influence the negotiations in the other (sub-)sectors.

Moreover, the availability of data (for negotiators, on their own country) and transparency of data (of other countries) is a major challenge. To have a basis for negotiation it would be necessary that developing countries provide information on their BAU trajectory, their envisioned ambition level (based on mitigation potentials and costs) and the maximum emission reduction level (including financing from credit generation) (Ward et al. 2008). For specific (sub-)sectors this information sits with industry representatives, who are not part of the UNFCCC process. One option would be that national subsectoral reduction targets would be agreed in other fora (e.g. by industry representatives) and the concluding information is passed on to negotiators. However, it is questionable whether this information would be sufficient for negotiators to come to agreements in the high level UNFCCC negotiation process, without back-checking with their industry representatives (Bradley et al. 2007).

We see two options to reduce the complexity of the negotiation process and facilitate the agreement process:

1. A climate treaty could specify only the principles for proposing ambition. The lev-

ers for environmental ambition would be defined in a technical process following the negotiation outcome (Schneider / Cames 2009).

2. In analogy to the CDM standardised baseline approach, one could try to define crediting baselines / levers for ambition for specific (sub-)sectors which would then be used for specific country groups. In defining such baselines, it could be helpful to bring together industry representatives from different countries.

Against this background, we see it as one objective of possible NMM pilots that they should explore questions of data availability:

- Which countries have sufficient data to negotiate and implement a sectoral crediting scheme?
- Which data is missing and what is the effort in capacity building to provide this data?

Furthermore, NMM pilots could explore whether it is possible to develop ambition levels for specific subsectors and country groups.

4.2 Avoiding double counting

Another key issue which strongly relates to the ambitiousness of new market mechanisms is double counting. The final texts of the UNFCCC negotiations in Durban and Doha explicitly stress that double counting needs to be avoided. However, precise definitions are still lacking so that three different types of double counting may still occur (Kollmuss et al. 2013):

1. **Emission reductions issued in more than one unit**

   The most obvious form of double counting is that emission reductions could be awarded credits twice, e.g. within the CDM and a sectoral crediting scheme. Even Parties, like New Zealand and Japan, who favour rather minimal accounting requirements agree to avoid this type of double counting.

2. **Emission reduction by host and buyer country**

   Some developing countries have explicitly mentioned in their pledge that they intend to use market mechanism credits to finance their pledges. However, this would lead to a situation in which both host and buyer country would claim emission reductions for the same mitigation action.

3. **Double counting of financial contribution**

   With view to the climate finance obligations of developed countries, one type of double counting is if a buyer of credits would use these credits to reduce its own mitigation obligations (offsetting) and define the cost of the purchased credits as part of its contribution to climate finance.

Within the scope of this paper, the second form of double counting is the most important one. In our view, it is important to clearly distinguish between emission reductions which are attributable to the countries' own efforts (including actions with international finance, e.g. through supported NAMAs) and emission reductions which are used to offset emissions in other countries. All the assessment carried out in chapter 3 are based on the principle that such a clear division is possible. Therefore, we consider it to be necessary to introduce procedures to ensure that generated credits are only counted towards the emission reduction of the final buyer/owner of the credits.

5 Conclusions

In the international climate negotiations it is increasingly acknowledged that in order to keep the 2° target, both developed and developing countries need to reduce their respective greenhouse gas emissions. This means that at least a fraction of developing countries' emission reductions cannot be offset against emissions in Annex I countries. Consequently, the Cancun Principles state that new market mechanisms are to contribute to "a net global decrease and/or avoidance of greenhouse gas emissions" (UNFCCC 2011).

Design Options for environmentally ambitious sectoral crediting

In this paper, we analysed how sectoral crediting, as one possible new market mechanism, can be designed in order to contribute to net mitigation effects. We assessed four different design options / methods to implement environmental ambition in a sectoral crediting

scheme. Under the assumption that the credit revenue would be the key incentive for mitigation actions in a sectoral crediting scheme, the methods show differences in how they would incentivise environmental ambition (see Table 5-1). The most important findings are:

- Discounting schemes offer the benefit of rewarding mitigation actions from the first ton saved. This makes them a good instrument to "get started". With a dynamic discounting approach, it becomes possible to specifically reward early action. However, these methods are not suitable to move to high ambition. Due to the discounting factor (per ton of emission reduction only a fraction of a credit is issued), mitigation ac-

Name of Method	Short Description	Pro	Con
Discounting	Credits are generated immediately below BAU, but for each ton reduced only x% of credits are issued	Any mitigation effort is rewarded with credits from the beginning	High ambition is not incentivised as discounted credits are less likely to cover costs of ambitious mitigation actions
Dynamic Discounting	The discounting rate is increased over time (e.g. x% per year)	Rewards early action since full credits are gained in the beginning	Higher MRV requirements through more frequent (e.g. annual) assessments of emission reductions
Ambitious Crediting Baseline	Credits are generated only if emissions are below a baseline well below BAU	Level of ambition / environmental benefit can be defined ex ante.	If baseline is too ambitious ("unreachable"), incentives to even start mitigation is low.
Dynamic Baseline Adjustment	The crediting baseline is adjusted based on previous (e.g. last years) emission reductions.	Partly compensates for inflated BAU scenarios	Higher MRV requirements as past sector performance defines future baselines

Table 5-1: Overview of methods to ensure environmental ambition

tions with higher costs may become unprofitable sooner than in e.g. an ambitious baseline approach.

- With ambitious baselines, the environmental ambition of a crediting scheme can be defined ex-ante. Thus, this approach is suitable to develop incentive schemes which are consistent with the atmospheric requirements. If the baseline is well-defined, developing countries could be stimulated to reduce their emissions as they would receive credits once the baseline is reached. Yet if the baseline is (perceived as) unrealistically high, the crediting mechanism would not incentivise any emission reduction at all.

Comparison to project-based approaches

In designing an ambitious sectoral crediting mechanism, a lot can be learned from experiences in the CDM. However, it is important to bear in mind that a sectoral approach is functionally different in many ways from a project-based approach.

One key aspect in sectoral crediting is that for all of the above design options, it is necessary to define a BAU scenario as a reference of future GHG emissions in the sector. The definition of the BAU (and a subsequent crediting baseline) replaces the necessary definition of additionality / standardised baseline in the CDM.

Defining such a BAU faces technical difficulties and is a politically highly sensitive process as it will determine the cost of credited mitigation actions. Basically two perspectives can be taken (obviously combinations of the two general approaches are possible):

- In some sectors, it may be more effective to take a bottom-up perspective, using project-based approaches from the CDM by scaling-up installation level mitigation potentials and benchmarks. This approach should work well in small (sub-)sectors with a limited number of actors and technical solutions.
- Other sectors may be more prone to take a macro perspective on emission trends and only assess the mitigation potentials top-down. Especially in heavily diversified sectors this approach may be more suitable.

Pilot activities for new market mechanisms could explore and compare different ways of defining BAUs and crediting baselines in different sectors and countries.

The role of pilot programmes to explore ambitious crediting schemes

Currently several institutions are supporting the development of pilot projects for new market mechanisms and specifically crediting schemes. It will be important in the design of these pilots to test how NMMs like sectoral crediting can effectively support the goal of net emission reductions beyond offsetting. From the theoretical analysis undertaken in this paper, we see the following challenges and questions:

- **Testing of all methods to implement environmental ambition**

  The above-described methods to implement environmental ambition have both advantages and shortcomings. To test their practicability, it would be good if the overall portfolio of NMM pilot projects would encompass all of these methods, possibly including variants or combinations.

- **Matching of sectors with methods**

  Different design options of new market mechanisms would yield different effects in the various sectors (Bolscher et al. 2012). In this respect it would be interesting to analyse whether any of the methods for environmental ambition would also be more suitable for one (sub-) sector or the other.

- **Impact of data availability on the effectiveness of crediting schemes**

  A key challenge in successfully implementing any ambitious sectoral crediting scheme will be to balance the environmental ambition correctly – to avoid windfall

profits by too low ambition, but not risking inaction by raising the bar too high. Obviously, availability of good data in the host country would be a prerequisite to define an adequate ambition level (BAU emission trajectories, mitigation cost estimates, etc.). However, it should be assessed whether the sensitivity to limited availability of data is equal in all of the four methods for ambitiousness.

- **Dynamic readjustment of ambition**

  Especially in the early phases of sectoral crediting implementation, it will be necessary to readjust the level of ambition, based on achieved emission reductions, newly available data and general experiences with the mechanism (see also section 3.8). Maybe it is even possible to design self-adjusting processes[6] .The dynamic discounting and baseline adjustment methods follows this line: the emission reduction of the previous assessment period defines the baseline / ambition for the next period.

Data availability is a key prerequisite for effective implementation of NMMs

Obviously pilot projects would look for good starting conditions (e.g. suitable sector, strong commitment of host government, good governance and MRV capacity in the country etc.) in order to show the feasibility of a sectoral crediting scheme and not to demonstrate failure.

However, as data availability has proven to be a key prerequisite for implementing an environmentally ambitious mechanism, it is important to be aware of the limitations implied by the lack of data.

- All pilot projects on NMM should explicitly foresee a rigid evaluation of the data requirements implied by the chosen approach. It needs to be assessed whether this type and quality of data would also be available in other countries and what capacity building efforts and time horizons would be to establish the required data.
- In a second phase of piloting NMMs, one could explicitly address countries or (sub-)sectors with poorer data availability in order to validate the practicability of procedures to develop BAUs and crediting baselines as well as other design options for NMMs.
- With a view to the negotiation process, it needs to be assessed in more detail whether all the countries who would participate in an NMM have sufficient data to negotiate crediting baselines and/or discounting factors.
- Furthermore, NMM pilots could explore whether it is possible to develop generalised ambition levels for specific subsectors e.g. for country groups.

Overall environmental ambition

One way to look at environmental ambition of any sectoral mechanism is to start with the overall ambition needed to stay within the 2°C limit. Based on deliberations in the fourth assessment report of the IPCC (IPCC 2007), den Elzen and Höhne conclude that by 2020 "emissions of non-Annex I countries as a group have to be below the baseline roughly between 15% to 30% for 450 ppm CO2-eq" (den Elzen / Höhne 2008).

In this report we have not taken this perspective. But it would worthwhile exploring what a 15% or 30% reduction below the national baseline would imply for different sectors. (Schneider / Cames 2009) argue that baselines for sectoral crediting would need to be higher than 30% as successful sectors would need to compensate for other sectors which fail to

[6] For example the German feed-in tariff has introduced continuous adjustment scheme: based on the installation level of the last assessment period, the feed-in tariff is automatically adjusted (up or down) to provide higher or lower incentives (BMU 2012).

reach such a level of emission reduction. One important research question would be to estimate cost implications: What are marginal costs for >15% or >30% emission reductions? This would serve as an key input to the discussion of how high demand for credits would need to be in order to stimulate net emission reductions in a sectoral crediting scheme, which can truly be called environmentally ambitious.

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