CREDITING EMISSION REDUCTIONS IN NEW MARKET BASED MECHANISMS – PART I: ADDITIONALITY ASSESSMENT & BASELINE SETTING WITHOUT PLEDGES

Final Report

Commissioned by the Ministry of Infrastructure and the Environment (I&M) of the Netherlands and the Federal Office of the Environment (FOEN) of Switzerland

Zurich, January 2014

Lambert Schneider, Juerg Fuessler and Martin Herren, with contributions from Michael Lazarus (Stockholm Environment Institute US)

B2459A NMM-FVA PART I.DOCX

INFRAS

BINZSTRASSE 23
POSTFACH
CH-8045 ZÜRICH
t +41 44 205 95 95
f +41 44 205 95 99
ZUERICH@INFRAS.CH

MÜHLEMATTSTRASSE 45
CH-3007 BERN

WWW.INFRAS.CH

CREDITING EMISSION REDUCTIONS IN NEW MARKET BASED MECHANISMS – PART I: ADDITIONALITY ASSESSMENT & BASELINE SETTING WITHOUT PLEDGES

Zurich, January 2014

Jointly commissioned by:

- The Dutch Ministry of Infrastructure and the Environment (I&M), Directorate of International Affairs, 2500 EX The Hague, and
- The Swiss Federal Office for the Environment (FOEN), Climate Division, CH 3003 Bern. The FOEN is an agency of the Federal Department of the Environment, Transport, Energy and Communications (DETEC).

Contractor

INFRAS, Binzstrasse 23, 8045 Zurich, Switzerland

Authors

Lambert Schneider, Juerg Fuessler and Martin Herren, with contributions from
Michael Lazarus (Stockholm Environment Institute US)

Support from I&M and FOEN

Lex de Jonge (I&M), Ferry van Hagen (I&M) and Laurence Mortier (FOEN)

Acknowledgments

The authors would like to thank I&M and FOEN for their valuable support, reviews and comments, and the participants of a related SBSTA side event of 13 June 2013 and of the Joint Workshop on FVA, NMA and NMM of 8 October 2013 in Bonn for their inputs, discussions and feedback.

CONTENT

GLOSSARY

Additionality:	Refers to the question of whether the emission reductions occur as a result of the policy intervention (the market mechanism)
Additionality assessment:	Assessment of whether agreed criteria for determining additionality are fulfilled
Allowance:	A tradable unit issued under a trading mechanism
Baseline setting:	Determination of the crediting baseline
BAU emissions:	Most likely level of business as usual emissions
Credit:	A tradable unit issued from a crediting mechanism
Crediting baseline:	Emissions level used as reference level for the issuance of units
Crediting mechanism:	A market mechanism in which credits are issued for actions that deliver emission reductions. The amount of credits is based on an ex-post comparison of monitored emissions against a crediting baseline, possibly adjusted for leakage emissions. The credits can be traded.
Leakage emissions:	Indirect emission effects that occur as a result of the market mechanism from emission sources that are not covered under the mechanism
Market mechanism:	All types of market mechanisms, including trading mechanisms and crediting mechanisms
Trading mechanism:	A market mechanism in which an emissions cap is set for the entire economy or sectors of the economy. Emission allowances corresponding to the cap are issued and allocated to the entities included in the mechanism. The entities must surrender an emission allowance for each ton of CO_2e they emit. The emission allowances can be traded between the entities included in the mechanism.
(Sub-)Sector:	A segment of the economy which is defined through outputs (the type of products or services), technologies and/or geographical boundaries
Units:	Tradable units which entitle the owner to emit one ton of CO_2e. Units include credits (from a crediting mechanism) or allowances (from a trading mechanism)

ABBREVIATIONS

BAU	Business as usual
BOCM	Japanese Bilateral Offsets Crediting Mechanism
CAR	Climate Action Reserve
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact fluorescent lamp
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
COP	Conference of the Parties
DOE	Designated Operational Entity
ERU	Emission Reduction Unit
ETS	Emissions trading scheme
FVA	Framework for Various Approaches
GDP	Gross domestic product
GHG	Greenhouse gas
GS	Gold Standard
GWP	Global warming potential
IRR	Internal rate of return
IET	International Emissions Trading
ITL	International Transaction Log
JI	Joint Implementation
LDC	Least Developed Country
MRV	Measurable, reportable, verifiable
MWh	Megawatt hours (energy unit)
NMM	New Market Mechanism
NAMAs	Nationally Appropriate Mitigation Actions
t	One metric tonne (of carbon dioxide)
PoA	Programme of activities
QELRO	Quantified Emission Limitation and Reduction Objective
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard

1. INTRODUCTION

Market based approaches are a key element in the international response to climate change. Under the Kyoto Protocol, three market based mechanisms were established, the Clean Development Mechanism (CDM), Joint Implementation (JI) and International Emissions Trading (IET). Many countries have introduced emissions trading schemes (ETS) as a key policy tool to mitigate climate change. Several jurisdictions and non-governmental organization established crediting mechanisms which are partially linked to ETS.

In Durban at 17th Conference of the Parties (COP 17) in 2011, Parties agreed on two tracks for negotiations on market based approaches: a framework for various approaches (FVA) under which both market and non-market based approach are discussed, and a new market mechanism (NMM). Both concepts have been further elaborated on at COP 18 in Doha in 2012. However, modalities and procedures that would govern these concepts are still missing.

This study aims to contribute to the on-going discussions in various fora, including the FVA and NMM, on how market based mechanisms need to be designed to deliver cost-effective, real, measureable, additional and permanent emission reductions. The study focuses on crediting mechanisms; it does not elaborate on design issues for trading mechanisms. The findings hold for crediting mechanisms under multilateral, bilateral, or domestic governance, and are hence relevant for both discussions under the NMM and the FVA, as well as other initiatives to establish new crediting mechanisms.

A pivotal part of any rules to govern crediting mechanisms are the rules to set the crediting baseline, i.e. the reference level used for the issuance of credits, and to assess additionality, i.e. assessing whether a mitigation activity would also have happened in absence of the crediting mechanism. Both issues are particularly relevant for the recognition of units from new crediting mechanisms and may be key issues for discussions under both the FVA and the NMM. This paper focuses on these two aspects.

The present part I of the study discusses baseline setting and additionality determination in the absence of any mitigation pledges in the host country. Part II discusses these aspects when a country has made mitigation pledges. Part I of the study mainly draws upon key lessons learned from existing crediting mechanisms, in particular the CDM due to its comprehensive regulatory and methodological framework which is often drawn upon by other crediting mechanisms.

In the following, we first provide an overview which design elements need to be addressed when establishing the NMM (chapter 2). We then introduce and classify three different crediting mechanisms: project based mechanisms, sector based mechanisms, and policy based mechanisms (chapter 3). We then turn to the main area of part I of the study and discuss methodological approaches for setting the crediting baseline (chapter 0) and assessing additionality (chapter 5), followed by a brief overview of some governance aspects that arise from setting crediting baselines and assessing additionality (chapter 6). Finally, we provide conclusions and recommendations (chapter 7).

2. OVERVIEW OF DESIGN ELEMENTS FOR CREDITING MECHANISMS

Policy makers face important decisions when establishing and designing a new crediting mechanism. The design choices determine the ability of the mechanism to deliver cost-effective, real, measurable, additional and permanent mitigation outcomes. **Table 1** provides an overview of key design elements for crediting mechanisms.

Design element	Description	Example(s)
Type of mechanism	› Project based mechanism › Sector based mechanism › Policy based mechanism	CDM, JI, Verified Carbon Standard (VCS), Gold Standard (GS), Japanese Bilateral Offsets Crediting Mechanism (BOCM)
Scope	› Eligible countries / sectors / project types › GHGs addressed	CDM: Exclusion of nuclear power and reducing emissions from deforestation, limitation to GHGs included in Annex A of the Kyoto Protocol
Participation requirements	› Country level: host / buyer country › Project level	CDM: Letter of approval from host country, regular submission of accurate GHG inventories by buyer countries CDM CCS projects: Host countries need to have legislation to address CCS related issues
Regulatory authority	› Multilateral › Bilateral › Host country › Non-governmental	› CDM, JI track 2 › BOCM › JI track 1 › VCS, GS
Third party assessment	› Accreditation › Performance monitoring › Enforcement: Incentives and penalties	CDM: Accreditation Standard and Procedure
Approval and issuance procedures	› Initial approval / subsequent monitoring of emission reductions › Transparency and documentation › Third party assessment	CDM / JI track 2 / VCS / GS: Public registry with relevant information and third party assessment

	› Public consultation › Fees › Enforcement	
Length of crediting	› Fixed versus renewable crediting periods › Requirements at renewal	CDM: 3 times 7 years or one time 10 years, 3 times 20 years or one time 30 years for afforestation and reforestation projects VCS: 10 years
Methodological approaches	See Table 2	
Registry	› Governance › Transparency › Security › Transaction requirements	CDM registry and national registries of Kyoto Protocol Parties with QELROs International Transaction Log (ITL) under the Kyoto Protocol
Accounting of units	› Quantitative limits / "supplementarity" › Carry-over between compliance periods › Double counting › Addressing non-permanence › Mandatory use / voluntary cancellation › Enforcement	

Table 1 Key design elements for crediting mechanisms

Type of mechanism. A crediting mechanism can target emission reductions from individual projects or programmes, from an entire sector, or from the adoption and implementation of policies. These three types of crediting mechanisms are described in chapter 3 below.

Scope. A crediting mechanism can target all or specific countries, sectors, project types and greenhouse gases (GHG). For example, the CDM can only be implemented in non-Annex I countries and some project types were excluded, such as nuclear power or emission reductions from reducing deforestation.

Participation requirements. Crediting mechanisms can establish participation requirements for the host country, the buyer country, and other entities involved in the mechanisms, such as the project developers. The participation requirements can, for example, relate to the reporting of GHG inventories, legislative requirements, approval or authorisation and other commitments under the United Nations Framework Convention on Climate Change (UNFCCC). For example, Kyoto Parties with Quantified Emission Limitation and Reduction Objectives (QELROs) need to regularly submit accurate GHG inventory information to be eligible to use mechanisms. Carbon capture and storage (CCS) projects can only be registered under the CDM if the host countries have agreed to implement CCS projects and have legislation in place which address issues such as procedures for the selection storage sites, liability and any non-permanence.

Regulatory authority. A regulatory authority is required to govern and manage the crediting mechanism. This authority can be established at multilateral level, such as the CDM Executive Board or the JI Supervisory Committee, at bilateral level, such as under the BOCM, by the host country, such as under track 1 of JI, or by non-governmental organizations, such as in the case of the Verified Carbon Standard (VCS) and the Gold Standard (GS).

Third party verification. Crediting mechanisms can require an independent verification by third party entities to assess whether proposals comply with established requirements and whether the claimed emission reductions were actually achieved. This requires establishing a system to accredit such entities or using an already existing system. For example, for the project-based mechanisms under the Kyoto Protocol, CDM and JI, independent verification is undertaken by private sector entities. Paragraph 79 of decision 2/CP.17 requires that "various approaches (...) must meet standards that deliver (...) *verified* (...) mitigation outcomes". Creating incentives and penalties for third parties to adequately check the requirements and monitoring the performance of the entities are key governance issues.

Approval and issuance procedures. The procedures for approval of proposals for crediting projects, sector or policies and for the monitoring and verification of mitigation outcomes are important elements to meet the objectives of a crediting mechanism. Key issues are a transparent and publicly available documentation of key documents, how stakeholders should be consulted, how the proposal is technically evaluated, including through third parties, and how the enforcement of requirements is ensured.

Length of crediting. Emission reductions from a crediting mechanism are credited for a defined duration. For how long emission reductions are credited, may be approached in different ways: methodological approaches may be used to estimate for how long the emission reductions are likely to occur as a result of the mechanism or the duration of crediting could be a policy choice. For example, under the CDM the duration is limited to three times 7 years or one time 10 years, and 3 times 20 years or one time 30 years for afforestation and reforestation projects. Under the VCS, all projects have a crediting period of 10 years.

Registry. Units need to be issued into a registry or can be traded between registries. A key challenge is to ensure transparency but also provide for a safe operation of the registries.

Accounting of units. Finally, adequate accounting of units is a key issue to ensure the integrity of the mechanism. The use of units towards meeting mitigation pledges can be limited to ensure that countries also reduce emissions domestically. The carry-over of units between compliance periods can be regulated, such as under the Kyoto Protocol. Addressing double counting can be particularly challenging in a fragmented carbon market with multiple mechanisms under different governance. Double counting can arise in different forms. In the case of double claiming both the buying countries and the host country claim the same emission reductions towards attaining a pledge. In the case of double issuance, the same emission reductions are credited under two different crediting mechanism. Another important area are accounting rules to address emissions that may only temporarily but not permanently be reduced, such as emissions or removals from forestry or emission reductions from CCS projects. Finally, units could not only be used for pledge attainment but also for voluntary purposes, such as companies or individuals that voluntarily offset their GHG emissions.

The ***methodological approaches*** of crediting mechanisms are another very important choice for ensuring that the principles set out under the UNFCCC to deliver "real, permanent, additional and verified mitigation outcomes" and "to avoid double counting of effort, and achieve a net decrease and/or avoidance of GHG emissions" are actually met.[1] Parties also agreed to address in their work programme on the FVA "a set of criteria and procedures to ensure environmental integrity of approaches in accordance with decision 2/CP.17, paragraph 79".[2] In practice, the quantification of emission reductions from crediting mechanisms involves considerable methodological challenges. **Table 2** provides an overview of key methodological issues for crediting mechanisms.

Methodological issue	Description	Example(s)
Additionality assessment	Assessment whether the emission reductions occur as a result of the incentives from the crediting mechanism	See **Table 10**
Baseline setting	Determination of the emissions level used as reference for quantifying the amount of emission reductions credited	See **Table 6**
Monitoring actual emissions	Requirements for monitoring the emissions from sources covered under the crediting mechanism	› Parameters determined once ex-ante versus parameters monitored continuously or regularly after project implementation

1 See paragraph 79 of decision 2/CP.17.
2 See paragraph 46 (c) of decision 1/CP.18.

		› Use of default values versus actual monitoring of parameters
Quantifying leakage emissions	Quantification of significant emission impacts on emission sources not covered under the mechanism	› Upstream and downstream emissions › Production shifts
Selection of GWP values	Determination which global warming potentials (GWPs) are used for non-CO2 gases	IPCC Assessment Reports

Table 2 Key methodological issues for crediting mechanisms

Assessment of additionality. Additionality refers to the question whether the emission reductions occur as a result of the market mechanism. If the emission reductions would occur also in the absence of the market mechanism (e.g. due to existing and enforced legislation), the issuance of units would undermine the integrity of the system: the use of the units would enable other entities to increase their GHG emissions, whereas no actual emission reductions occurred as a result of the mechanism. For this reason, paragraph 79 of decision 2/CP.17 requires that "various approaches (...) must meet standards that deliver (...) *additional* (...) mitigation outcomes". Similarly, paragraph 51 of decision 1/CP.18 makes reference to "standards that deliver (…) additional (…) mitigation outcomes" in the context of the NMM discussed under UNFCCC.

Baseline setting. The crediting baseline refers to the emissions level which is used as reference for quantifying the amount of emission reductions credited. Baseline emissions can be based on the most likely business as usual (BAU) development or they may be set at a lower, more conservative level, e.g. by using ambitious emission benchmarks. Parties agreed to consider in their work programme for the NMM "criteria, including the application of conservative methods, for the establishment, approval and periodic adjustment of ambitious reference levels (crediting thresholds and/or trading caps) and for the periodic issuance of units based on mitigation below a crediting threshold or based on a trading cap".[3]

Monitoring actual emissions. The actual emissions from sources covered under the crediting mechanism need to be quantified in order to compare them with the baseline emissions. The quantification of actual emissions usually occurs *ex-post* through monitoring. Ex-post monitoring reduces the uncertainty and sets incentives for entities under the mechanism to actually achieve the envisaged performance.

[3] See paragraph 51(f) of decision 1/CP.18.

Quantifying indirect emission effects attributable to the mechanism ("leakage emissions"). In some cases, mechanisms can significantly impact emission sources outside the coverage of the mechanism. For example, the increased use of biomass in a sector may result in enhanced deforestation rates elsewhere. Emissions may also be shifted from emission sources within the coverage of the mechanism to emission sources outside, commonly referred to as *carbon leakage*. For example, a mechanism addressing the steel industry could result in the closure of steel plants and the production of steel in other countries.

Global Warming Potentials. Crediting mechanisms that address non-CO_2 gases need to use a common metric to convert the emission reductions in tons of CO_2 equivalent. Commonly, values from IPCC assessment reports for a 100 year period are used.

Quantifying the overall emission reductions. The overall emission reductions that are being credited correspond to the baseline emissions minus the monitored actual emissions minus any leakage emissions.

All of these methodological aspects are important to ensure that the principles set out by Parties under the UNFCCC for mechanisms are met. However, this report focuses on the assessment of additionality and the determination of the crediting baselines, as they are methodologically particularly challenging and have inter-linkages to the overall architecture of a future climate regime. In chapter 0 and 5 further below we provide an overview of different methodological approaches for baseline setting and additionality assessment and discuss their advantages, prospects and risks. We start with discussing approaches for baseline setting since the determination of additionality is often closely linked to the approaches used for baseline setting.

3. APPROACHES FOR CREDITING MECHANISMS

3.1. BACKGROUND

The FVA and NMM were both established in n Durban at COP 17 in 2011 and further elaborated on at COP 18 in Doha in 2012. At COP 19 in Warsaw in 2013, Parties could not agree on the way forward on the FVA and NMM. The scope of both approaches is not yet fully defined. Parties expressed different views in their submissions on the scope and content. The FVA could be a mechanism to provide transparency and international oversight on the use of units to attain pledges under the Convention and possibly in a future climate regime. It could, for example, include common guidelines or rules for accounting of units and the design of mitigation schemes to ensure quality and facilitate fungibility of units under the UNFCCC. The NMM has been “defined”, however modalities and procedures for such a mechanism are to be developed yet (INFRAS 2013).

The scope, functioning and difference between a FVA and the NMM are not very clear at this point in time and most issues under discussion are overlapping (e.g. avoiding double counting, ensuring net decrease in emissions and environmental integrity or the tracking of units). However, views on the governance in the negotiations range from the preference for the minimization of UN oversight and thus a maximum of de-centralization and flexibility to Parties on how to govern and manage the approaches, to the view that environmental integrity and accountability can only be assured with centralized (UN) oversight.

In this study we focus on crediting mechanisms. Trading mechanisms, such as emission trading systems, are not at the centre of this analysis. Based on the negotiations on the NMM and FVA and ongoing activities outside the UNFCCC, such as road testing of new market based approaches, we categorize crediting mechanisms into three relatively broad types of mechanisms:

› **Project based mechanisms** are crediting mechanisms where individual projects, or programmes including several activities, are credited against a crediting baseline. A project may be implemented in one or several installations, households or entities and may include one or several mitigation activities. Each installation, household or entity can decide whether or not to participate in the mechanism. Under the Kyoto Protocol, project-based crediting mechanisms were implemented through the CDM and JI. A number of other mechanisms are governed by governmental or non-governmental organizations, including, among others the Verified Carbon Standards (VCS), the Gold Standard (GS), and the Climate Action Reserve (CAR).
› **Sector based mechanisms** are crediting mechanisms that are applied to one or more segments of the economy. Segments could be represented by sectors, sub-sectors, technologies or geographic regions in the host country. Once the segment is defined, all entities within the segment participate in the mechanism. The crediting baseline is established for the entire segment of the economy and emission reductions are credited based on the difference between the sectoral crediting baseline and the actual emissions of all entities within the segment of the economy. The scale of emission reductions from such a mechanism could potentially be larger than for project based mechanisms. This type of mechanisms could potentially be implemented as the NMM. Also credited nationally appropriate mitigation actions (NAMAs) or the crediting of activities for reducing emissions from deforestation and degradation (REDD) are potential sector based mechanisms.

› **Policy based mechanisms** are crediting mechanisms that credit the emission reductions resulting from the adoption and implementation of policies. This could, for example, include governmental regulations, such as energy performance standards, as well as (financially backed) policies, such as a CO_2 tax. This type of mechanism is not concisely defined by scale or procedures and might overlap with sector or even project based approaches. For example, national energy efficiency policies could be transformed into sectoral targets according to which emissions allowances are distributed. Typically, policy based crediting mechanisms are implemented on aggregated level such as sectors or regions. The scale of emission reductions from policy based mechanisms could potentially be larger than for project based approaches. As for sector based mechanisms, the crediting of policies could potentially be implemented as the NMM or as credited NAMAs.

Each of these mechanisms can be established in various ways that are briefly discussed in the following.

3.2. PROJECT BASED MECHANISMS

Project based mechanisms calculate the emissions reductions against a crediting baseline applied to a specific project or a program of activities. The crediting baseline can be based on the specific characteristics of the project activity or be standardized. In the latter case, the same emission factor or baseline scenario is assumed for all projects with similar features within a defined geographical scale. The crediting baseline is commonly determined following a set of predefined methods, which are often referred to as "baseline methodologies".

Under project based mechanisms, the project proponent needs considerable capacities and resources to develop projects while the amount of emission reductions of individual projects is limited. For a discussion of the strengths and weaknesses of project based mechanisms see for example Michaelowa (2012).

The Kyoto Protocol's flexible mechanisms include two project based offsetting mechanisms: the CDM and the Joint Implementation (JI). For these mechanisms, international oversight is provided through the CMP, its regulatory bodies, the CDM Executive Board and the JI Supervisory Committee, and the Parties involved in projects. The CDM Executive Board provides policy oversight, adopts methodologies, accredits Designated Operational Entities (DOEs) for validating projects and verifying emission reductions, and registers projects and issues Certified Emission Reductions (CERs). Under JI, emission reduction units (ERUs) can be issued under two different tracks. Under track 1, the governance is under the control of the Parties; they decide on the approval of the projects and issuance of ERUs. Under track II, the JI Supervisory

Committee has similar oversight functions as the CDM Executive Board. Based on the experiences from the past ten years or so, the rules governing these mechanisms were further developed. It is currently discussed under the UNFCCC whether or not the NMM should be a new project based mechanisms and what kind or type of project based credits could be encompassed under the FVA.

Various approaches exist on how the processes for the development, implementation and monitoring of projects could be designed. A future project based NMM[4] and project based mechanisms under the FVA may for example build their baseline setting and crediting procedures on reformed processes of the CDM. **Table 3** gives an overview of potential options for key design elements (not exhaustive).

Processes	Design	Example
Baseline setting	› Project specific baselines › Standardized baselines	Historical emissions of the facility Grid emission factor, emission performance benchmarks Alternative success indicators)
Additionality assessment	› Investment analysis › Barrier Analysis › Common practice › CER impact analysis › Positive / negative lists › Standardized criteria (e.g. performance benchmarks)	Automatic additionality for micro/small scale projects
Differentiation of requirements	› Scale of project › Project type › Origin of host Party	Special (simplified) requirements for Least Developed Countries (LDCs) or economies in transition (EITs) Simpler requirements for small projects, more rigorous requirements for large projects

Table 3 Typical design issues specific to project based mechanisms

4 It is not clear at this point if NMM would allow for project based approaches. As this study does essentially not distinguish between NMM and FVA, we leave this question open and continue to analyse project based approaches.

3.3. SECTOR BASED MECHANISMS

Sector based mechanisms credit emission reductions from an entire sector against a sector wide crediting baseline. Typically, sectors that emit large amounts of greenhouse gases (e.g. cement, steel, paper or refineries) are particularly interesting for a sector based crediting mechanism. The outputs, the technologies (with considerable abatement potential), or typical processes in a particular sector (such as clinker production) could be used to define the boundaries of the sector.

Under a sector based crediting mechanism, crediting baselines are set on a sectoral level. This raises the question how individual entities in the sector receive incentives to reduce emissions. While all kind of approaches using financial incentives and crediting thresholds for individual entities could exist, the following approaches are currently under discussion (see Table 4 below): either the host country implements policies to reduce emissions in the sector, such as financial incentives which could be partially re-financed through the sale of credits, or the host country devolves the sectoral crediting baseline in crediting thresholds for individual entities. The entities then receive credits against their crediting threshold. In this case, mechanisms are needed to compensate for those entities where the emissions are above the crediting threshold. For example, these entities could be obliged to purchase and retire credits from other entities of the same sector if they do not meet the crediting threshold. A further option could be that participation of entities would be voluntary in such system. However, this approach would also require a system in order to avoid over-crediting in case of some entities' emissions would increase to their individual crediting thresholds.

As for project based approaches, the environmental integrity of a sector based crediting mechanism depends largely on the governance structure, the stringency of the crediting baselines, and appropriate accounting of units. For example, while intensity based crediting baselines reduce the risk of over-crediting at the same time there is a risk of relocation of production outside the mechanism boundaries by entities with high emission intensities. Environmental integrity also depends on further factors such as an appropriate MRV system, third party validation or that double counting and non-permanence is addressed.

Currently, there are no crediting mechanisms operational that encompass an entire sector. However, standardised baselines and programmes of activities under the CDM can be considered a precursor of sectoral approaches that experiences can be drawn from (Prag, Briner 2012). The European Commission in particular is bringing forward the idea of sectoral approaches in climate negotiations (UNFCCC 2012). **Table 4** summarizes two proposals and highlights their potential and challenges according to a report for the European Commission (EC 2012). **Table 5** summarizes options for key design elements of sector based crediting mechanisms and provides some examples.

	Approach	Potentials	Challenges
Government Crediting System	Host country government adopts sectoral crediting threshold and implements sectoral policies to attain target. Credits accrue to host country government. Approach particularly suitable for state-owned sectors.	› Simple and aggregated approach › Low transaction costs › Also sectors with numerous entities can be covered › No intra sectoral leakage › Broad range of mitigation options	› Credits ex-post, thus upfront investment needs incentives › Data uncertainty high › Sectoral emission inventory needed
Tradable Intensity Standards	Host country government adopts sectoral crediting threshold that is devolved to individual emission sources. Entities will then receive credits for achieving emissions below targets.	› Broad range of mitigation options	› No loose targets might undermine environmental integrity › Administrative efforts might be considerable › Delay in crediting, thus upfront investment needs incentives › Political resistance from entities towards imposed targets › Risk of intra sectoral leakage (if participation is voluntary)

Table 4 Proposal by the European Commission for Sectoral Approaches

Aspects	Options	Specifications / Examples
Boundaries and grouping of emitters	› By product, output, technology, process type, vintage of entity	Depending on the number and heterogeneity of emitters
Scale of crediting	› Sector level	Credits for emissions on aggregated, sectoral level only (EC 2012, p37)
	› Entity level	Credits based on individual targets for emitting entities (EC 2012, p40)
Participation of entities	› All entities of a sector	Only feasible if number of entities in sector small
	› Only Entities with large emissions	E.g. only large emitters over 25kt CO_2 eq./a, this can be coupled to opt in/out possibility
	› Voluntary	Voluntary participation in system

Table 5 Design issues specific to sector based crediting mechanisms

3.4. POLICY BASED MECHANISMS

Policy based mechanisms could emerge in various forms, including as the NMM or under the FVA. They would seek the crediting of emission reductions achieved from the adoption, implementation and enforcement of a policy in a host country. This could, for example, include crediting emission reductions from the implementation of performance standards (e.g. efficiency standards for refrigerators), provision of subsidies (e.g. credit revenues to refinance feed in tariffs), regulations and their enforcement (e.g. ban of incandescent light bulbs), (carbon) taxes or a re-structuring of energy subsidies. Such policies could for example be applied to a specific sector, subsectors or technologies and crediting would occur against a crediting baseline defined at the outset or ex-post. The credits would be awarded to host country. Another example could be the adoption and implementation of a domestic ETS, where the crediting baseline could correspond to the cap set for the ETS. Any overachievement in the ETS could then be credited and the country could allow entities included in the ETS to be rewarded for such overachievements. This form of policy based mechanism could also be regarded as a sector based mechanism, as all entities within defined sectors are usually included in ETS.

Possible design options for this type of mechanism are less concrete than for the other two mechanisms: there are few discussions about how additionality could be defined, how emission reductions could be attributed to respective policies and be quantified, and how the causality between the implementation of the policy and emission reductions could be determined. Examples of policies that intend to include crediting are, for example, the Urban Transport Modernization Plan for Santiago in Chile (DNV, 2004a)[5], a Mandatory Energy Efficiency Standard for Room Air Conditioners project in Ghana (DNV, 2004b)[6] or Mexico's housing NAMA[7].

[5] http://www.dnv.com/focus/climate_change/Upload/CDM_PDD_English1.pdf
[6] http://cdm.unfccc.int/filestorage/F/S/_/FS_837046608/Standards10-21fin.pdf?t=WHF8bWxyMzhvfDB5VsU4CK8oSgu6B0-5fTjy
[7] http://www.perspectives.cc/typo3home/groups/15/Publications/NAMA_Design_Mexico_Working_Paper.pdf

4. BASELINE SETTING

This chapter discusses approaches to quantify baseline emissions from crediting mechanisms in the absence of mitigation pledges in the host country. Part II of this study then focuses on approaches that derive crediting baselines from different types of mitigation pledges. In the absence of pledges, crediting baselines are usually derived from socio-economic, GHG emissions, and technology and cost data. These approaches are widely used in current crediting mechanisms, such as the CDM and JI and ETS.

In this context, the term "crediting baseline" refers to the emissions level that is used as reference for the purpose of issuing units from a crediting mechanism (see glossary above). A crediting baseline may be set at or below the most likely BAU emissions level (see section 4.3 below). Please note that in other contexts the term *baseline* is sometimes also used in the context of national emission reduction or limitation pledges to define a BAU reference level of emissions on a national or sectoral level (e.g. China pledged a 20% reduction below the BAU emissions in 2020 as projected in 2007).

4.1. OVERVIEW OF METHODOLOGICAL APPROACHES

Baseline emissions from crediting mechanisms can be derived and quantified using a variety of methodology approaches. Over the past fifteen years, many different approaches have been developed and applied, mainly in the context of baseline setting for project-based and programmatic offsetting, allocation of allowances under emissions trading schemes, and projections of GHG emissions in sectors and for the entire economy.

The suitability of the approaches for baseline setting depends on the type of crediting mechanism (see chapter 3). Some approaches only work for one of the mechanisms (project based, sector based, or policy based), others can work for two or all three of them. **Table 6** provides an overview of methodological approaches which may be used for the different types of crediting mechanisms.

The quantification of baseline emissions often requires the collection of different types of data, including activity data, emission factors, technical parameters or cost data. In many cases, different approaches can be used to collect the different data required for setting a crediting baseline. For example, for renewable energy generation projects baseline emissions can be determined based on the amount of electricity generated (the activity data) and a grid emission factor (the emission factor). In this example, the electricity generation can be easily monitored ex-post, while the emission factor could be determined through a range of different approaches, such as the performance of a peer-group of plants or the identification of a reference technology.

In this regard, the approaches in **Table 6** will often be combined for setting the crediting baseline. The table indicates also key issues that can typically arise from the approach. These issues and criteria to select the most suitable approach for the relevant project type, sector or policy are further discussed in section 4.2 below.

Approach	Applicable mechanism	Examples of suitable sectors / project types	Key issues
1) Use of historical data from the installations included in the mechanism			
Average or more conservatively selected emission factors or activity data over a defined historical period (e.g. 3 or 5 years)	Project	Historical electricity generation data for retrofit projects in the power sector	Innovation
Information campaigns to establish baseline emission factors	Project Sector	N_2O emission factors for nitric acid production[8] Performance measurement of an existing boiler which is replaced	Perverse incentives Innovation
Extrapolation of historical trends in emissions or emission factors	Project Sector Policy	Extrapolation of the historical trend of energy efficiency of new household appliances	Uncertainty
2) Ex-post monitoring at the installations / entities included in the mechanism			
Ex-post measurement of activity data at the installations	Project Sector Policy	Measurement of electricity generation from renewable power generation	
Ex-post measurement of GHG generation, performance or other parameters at the installations	Project Sector Policy	Monitoring of methane capture at landfills Monitoring of N_2O formation at nitric acid plants	Perverse incentives
Ex-post surveys	Project Policy	Survey to assess the behaviour of passengers of a bus rapid transit system	Uncertainty
3) Identification of a reference technology			
Identification of a reference technology through economic analysis	Project Sector Policy	Investment analysis to identify the economically most attractive type of power plant	Cost variations in some industries Data availability
Identification of the reference technology through analysis of market penetration of different technologies	Project Sector Policy	Assessment of the market penetration of different types of lamps	Selection of the market penetration level that sets the crediting baseline Data availability
Identification of a reference technology through performance data (e.g. best available technology)	Project Sector Policy	Assessment of performance data of different nitric acid production technologies for greenfield projects	Data availability

[8] The CDM Executive Board released guidance on the expansion of industrial gas recovery methodologies to new facilities (EB 46 Annex 10). In this context also a note was published that explains the rationale for the baseline emission factor in the draft approved methodology for new nitric acid plants.

4) Use of peer group data			
Benchmarking: use of data from a defined peer group	Project Sector	Benchmarks in the cement sector expressed in tonnes of CO_2 per tonne of clinker produced	Data availability Level of aggregation Use of national or international data
Ex-post sampling of a "control group"	Project Policy	Compact fluorescent lamps (CFLs): sampling of CFL distribution at households which do not participate in a CFL programme	Data availability
5) Modelling			
Top-down models (e.g. macro-economic modelling)	Sector Policy	General equilibrium models to assess the future emissions of sector under different GDP growth scenarios	Transparency and underlying assumptions of the model Uncertainty
Bottom-up models (e.g. sector models)	Project Sector Policy	First order decay model to quantify methane emissions from avoided dumping of waste in a landfill	Transparency and underlying assumptions of the model Uncertainty

Table 6 Overview of methodological approaches for baseline setting

4.2. KEY ISSUES FOR SELECTING A SUITABLE METHODOLOGICAL APPROACH

In selecting a suitable approach, a number of different issues need to be taken into account. The following are particularly important:

› The **type of the crediting mechanism**, i.e. whether the mechanism is project based, sector based or policy based. As indicated in **Table 6** above, some methodological approaches may only work for some type of crediting mechanisms.
› The **level of aggregation**: a mechanism may cover an entire sector (e.g. the power sector), a sub-sector (e.g. wind power generation) or specific activities within a sector (e.g. household lightening or the retrofit of small hydro power plants). For entire sectors with a range of different installations, benchmarks or modelling could, for example, provide more reliable outcomes than the use of a specific reference technology. The choice in the level of aggregation also strongly impacts which activities can receive credits and which not, and thereby defines the type of GHG abatement measures that can be credited (e.g. product based aggregation versus technology based aggregation).

- The **size, number, vintage, and technical lifetime of the installations**: in some sectors, the plant size and/or plant age can significantly influence costs and performance. In such cases, the plant features may need to be considered in the aggregation level of the mechanism. Some baseline approaches, such as the use of peer-group data or the selection of a reference technology based on a market penetration analysis only work in sectors with many installations.
- The **comparability of performance and costs of technologies**: in some (sub-) sectors, for one technology the costs and performance does not vary significantly between plants, whereas in other sectors, different plants using the same technology can have significantly different performance and costs. For example, in the case of household lightening all incandescent lamps have comparable costs and performance, as have all compact fluorescent lamps (CFLs) and all light-emitting diode (LED) lamps. In such cases, a reference technology or mix of references technologies could be used as crediting baseline. In contrast, in the power generation sector, for example, the cost and performance can vary considerably within one technology. For example, the electricity generation costs of hydro power plants depend considerably on geographical features such as available capture area and precipitation patterns. The performance of wind power plants depends considerable on the wind availability.
- The **types of outputs or services** provided by the entities or installations, e.g. whether the products are homogenous (e.g. electricity, steel) or heterogeneous products (e.g. different types of glass) or whether an installation produces multiple products (e.g. refineries, co-generation) or a single product (e.g. clinker, nitric acid, electricity). Several baseline approaches, such as benchmarking, reference technologies or use of historical data are challenging for sectors with multiple heterogeneous products and co-production of different products in one plant.
- The **rate of current and future expected innovation** in the sector: some sectors undergo rapid transformation with significant changes in costs and performance of technologies, while in other sectors innovation occurs at lower rates. In sectors with high rates of innovation the crediting baseline may need to be updated more frequently than in sectors with lower rates. Some approaches, such as the use of historical data, do not reflect innovation in the sector and may thus not be suitable for some sectors.
- Other **technical, economic and social circumstances**, such as, availability of (bio-) fuels, whether the installations are exposed to international competition, whether the mechanism

may create perverse incentives, or which barriers are faced in the sector (e.g. rural households facing barriers to access energy).

- The **regulatory environment**, including policies that may impact GHG emissions in the sector, in particular over longer time periods (see section 4.6).
- **Data availability** may be limited due to lack or confidentiality of data. Some approaches, such as benchmarking or modelling rely more heavily on the ex-ante availability of sector-wide data than others and may therefore not be suitable for all sectors/countries.

4.3. AMBITION AND CONSERVATIVENESS OF CREDITING BASELINES

The ambition and conservativeness of crediting baselines is a key policy choice. Baseline emissions can either represent the most likely BAU emissions development or they can be set at a lower, more “ambitious” or “conservative” level. For instance, Paragraph 50(f) of decision 1/CP.18 refers in the work programme for the NMM to the “application of conservative methods” and “ambitious reference levels”. This supports setting the crediting baseline at conservative and ambitious levels.

Setting a crediting baseline below the most likely BAU emissions level can be motivated by different reasons. Firstly, a crediting baseline below the BAU emissions level can provide a means to achieve a “**net decrease and/or avoidance of greenhouse gas emissions**”, a principle set out for various approaches in paragraph 79 of decision 2/CP.17. A net decrease and/or avoidance of GHG emissions is achieved if the amount of credits issued and used for compliance is lower than the emission reductions achieved through the crediting mechanism. In this case, the crediting mechanism does not only reduce the cost for achieving a given GHG mitigation target but also directly reduces emissions to the atmosphere. A net decrease and/or avoidance of GHG emissions could be achieved through different means[9], including the following two approaches:

- Setting the crediting baseline below the BAU emissions level, which ensures that less credits are issued than emission reductions are achieved; or
- Cancelling a fraction of the issued credits, which ensures that some credits are not used for compliance.

[9] See, for example: Bakker et al. 2009; Larazus et al. 2013, Vrolijk and Phillips 2013

Secondly, a crediting baseline can be established below the BAU level in order to prevent that **perverse incentives** or **market distortions** result in over-crediting. This applies in particular to sectors in which the revenues from the crediting mechanism provide significant incentives for plant operators to maximize credit generation. For example, in the case of projects destroying gases with high global warming potential (GWP), plant operators can have economic incentives to maximize the GHG generation in order to gain more carbon market revenues from the destruction of the gases. This applies, for example, to the abatement of the by-product HFC-23 from HCFC-22 production where the revenues from the carbon market to destroy HFC-23 can exceed the costs of producing HCFC-22 (Schneider 2011). To avoid incentives to artificially inflate the HFC-23 generation, the CDM Executive Board adopted for these projects a conservative baseline emission rate (1%) which is well below the typical emission rates observed in the sector (1.5% to 3%). In such cases, conservative emission factors can avoid perverse incentives or market distortions which could otherwise result in production shifts and consequent carbon leakage.

And lastly, setting a crediting baseline below the BAU emissions level is being discussed as a way to partially address the inherent **uncertainty** associated with establishing crediting baselines. The uncertainty with regard to baseline emission levels arise from different sources:

› **Assumptions on future developments**: a BAU baseline is commonly derived based on assumptions on future developments, such as the development of prices and costs of outputs and inputs, GDP growth, the rate of technological innovation, the future regulatory environment, etc. Such assumptions are often associated with high uncertainties and may also be politically driven. For example, official GDP projections often tend to over-estimate the actual development of the GDP. The uncertainty of assumptions on future developments increases with the timeframe: the emissions development of the next 5 years is more certain than the development over 20 years.
› **Model uncertainty:** the models used to quantify GHG emissions are often associated with significant uncertainty. For example, the first order decay model[10] to estimate methane generation from waste often overestimates actual emissions from landfills.
› **Parameter uncertainty:** the parameters used to quantify GHG emissions are often not accurate or consistent, or data is not available and needs to be derived from other sources.

[10] Landfill methane generation can be projected using this model. First order decay models assume that landfill methane generation is at its peak shortly after initial waste placement and then decreases exponentially (i.e., first order decay) as the organic material in the waste decreases as it is degraded by bacteria in the landfill (EPA 2008).

› **Measurement uncertainty:** direct measurements of parameters involve measurement uncertainty. For most parameters, this source of uncertainty is significantly smaller compared with the previous sources of uncertainty.

All these sources of uncertainty can result in significant under- or over crediting. The degree of uncertainty varies strongly and depends on the type of GHG abatement, the sector and the country. The uncertainty associated with setting the crediting baseline may, to a certain extent, be addressed by making conservative assumptions in setting the baseline. The principle of using a conservative approach to account for uncertainty was established in the modalities and procedures for the CDM (paragraph 45(b) of the Annex to decision 17/CP.7) but the degree of conservativeness was not specified.

In discussing the ambition or conservativeness of crediting baselines it is important to distinguish these different aspects and to understand their inter-linkages. For example, if uncertainties are large and the degree of conservativeness applied is low, the crediting baseline may not necessarily result in a net decrease of GHG emissions or may even lead to a net increase in emissions. On the other hand, very conservative assumptions in establishing a crediting baseline may not only address uncertainty but also result in a net decrease of GHG emissions. In other words: the lower the uncertainties associated with the baseline emissions and the more conservative the crediting baseline is selected, the higher the likelihood that a net decrease of GHG emissions is achieved. Setting crediting baselines at very conservative or ambitious levels, such as for HFC-23 abatement under the CDM, can also simultaneously address perverse incentives and market distortions and lead to a net decrease of GHG emissions.

If a crediting baseline is set at a "conservative" or "ambitious" level, an important question is which degree of conservativeness / ambition should be applied. Firstly, the degree of conservativeness / ambition may depend on the motivation for setting the crediting baseline conservatively:

› If the crediting baseline is set below BAU emission levels in order to achieve a **net decrease of GHG emissions**, the degree of ambition of the crediting baseline is a policy choice which could be informed by various criteria, such as the overall necessity for mitigation ambition or common but differentiated responsibilities and respective capabilities. If the crediting baseline is derived from a pledge in the country, the crediting mechanism may partially help to meet the national pledge and may partially issue credits that can be traded internationally (see part II of this study).
› If the crediting baseline is set below BAU emission levels in order to **avoid perverse incentives**, the degree of conservativeness could be based on a level which ensures that such

incentives are addressed with a high confidence. For example, in the case of HFC-23 abatement from HCFC-22 plants, the baseline emission factor under the CDM was set at the lowest value a plant in the world ever achieved. In the case of the steel industry, the same baseline level may be used for all countries in order to avoid market distortions and carbon leakage, and to provide a level playing field for the industry.

› If the crediting baseline is set conservatively in order to **address the uncertainty** associated with establishing the baseline, the degree of conservativeness could depend on the degree of uncertainty. This approach ensures that the level of conservativeness is correlated to the issue that should be addressed. This approach has been used both in CDM methodologies and GHG inventories. Some CDM methodologies provide conservativeness factors to account for the uncertainty of individual parameters or overall emission reductions. Under the Kyoto Protocol, GHG inventories are conservatively adjusted in cases where GHG emissions are not correctly reported. The uncertainty of the emission estimate for the sector is taken into account in determining the adjustment factor. The higher the uncertainty, the larger the adjustment. However, if the GHG inventory is reported correctly, no adjustment is applied. Adjustments for GHG inventories and most CDM methodologies apply a single standard deviation, corresponding to a 68% confidence level. Some CDM methodologies also use a 95% confidence level to determine baseline emissions (e.g. in the case of some methodologies involving sampling).

Finally, in considering the ambition of the crediting baseline it is important to consider the implications for both global mitigation outcomes and costs. From economic theory, the carbon market is most cost effective if the crediting baseline of a crediting mechanism is exactly set at the BAU emissions level. In this case, each credit corresponds to exactly one tonne of CO_2 equivalent and the most cost effective measures are used to abate GHG emissions. The impacts of more ambitious and more lenient crediting baselines than the BAU emissions level are summarized in **Table 7**. Both setting the crediting baseline at more ambitious or more lenient levels than BAU emissions will reduce the cost effectiveness of the carbon market:

› In the case of a more lenient crediting baseline than the BAU level, the market participants receive more credits than they reduce emissions. This increases the global costs of GHG abatement to achieve a given global emissions goal through two effects:
    - o Market participants may implement GHG abatement options which would not be cost effective with a BAU emissions crediting baseline.
    - o The more lenient crediting baseline does not impact the measures being implemented under the crediting mechanism because the measures would also be economically via-

ble with a BAU emissions baseline. In this case, the excess issuance would need to be compensated by additional measures being taken elsewhere to achieve the same global GHG abatement.

- In the case of a more ambitious crediting baseline than the BAU emissions level, the market participants receive less credits than they reduce emissions. This can have two different effects:
  - The ambitious crediting baseline reduces the GHG abatement potential from the crediting mechanism, as some GHG abatement options would be economically feasible with a BAU baseline but are not feasible with a more ambitious crediting baseline. This increases the global cost of GHG abatement to achieve a given global emissions goal because less cost effective credits are available from the crediting mechanism, and other more costly measures need to be undertaken to achieve the same GHG abatement.
  - The ambitious crediting baseline does not reduce the GHG abatement potential from the crediting mechanism, as the available GHG abatement options are still economically feasible with the more ambitious crediting baseline. In this case, a higher level of global GHG abatement is achieved, which, however, would be achieved more cost effectively with more stringent caps or targets by buying countries and a crediting baselines set at the BAU emissions level.

While setting crediting baselines at both more ambitious and more lenient levels compared to the most likely BAU emissions increase the global cost of GHG abatement to achieve a given global emissions goal, the impact on global GHG emissions varies. More lenient crediting baselines than the BAU emissions level increase global GHG emissions, as more credits are issued than emission reductions are achieved. More ambitious crediting baselines than the BAU level can have no impact or reduce global GHG emissions. A more ambitious crediting baseline would not have any impact on global GHG emissions if the crediting baseline is set prohibitively ambitious so that no measures at all are implemented under the crediting mechanism. If some measures under the crediting mechanism are economically viable despite the more ambitious crediting baseline, the global GHG emissions are reduced because less credits are issued and used than emission reductions are achieved.

Ambition of the crediting baseline	Impact on global GHG abatement	Impact on global costs of GHG abatement
The crediting baseline is more lenient than the BAU emissions	Higher global GHG emissions (i.e. the global abatement target is not reached)	Higher global abatement costs to achieve a given global emissions goal
The crediting baseline is more ambitious than BAU emissions	No impact (if no measures are implemented under the crediting mechanism due to a prohibitive ambitious crediting baseline) Lower global GHG emissions (if measures are implemented under the crediting mechanism despite the ambitious crediting baseline)	Higher global abatement costs to achieve a given global emissions goal

Table 7 Possible impacts of crediting baselines that are more ambitious and more lenient than the BAU level.

In conclusion, uncertainties and potential perverse incentives, such as market distortions, should be systematically assessed and, if relevant, be taken into account by establishing the crediting baseline in an appropriately conservative manner. A net decrease of GHG emissions could either be achieved through the cancellation of units or through the establishment of conservative crediting baselines. If a net decrease of GHG emissions should be achieved through establishing conservative / ambitious crediting baselines, the uncertainty associated with the BAU emissions should be assessed in order to ensure that the envisaged ambition level is actually achieved.

The analysis shows that both setting the baseline below or above BAU emissions, by creating inefficiency, increases the cost of achieving a given global emissions target. However, the impacts vary with regard to global GHG emissions. In this regard, the overall adverse impacts of too lenient crediting baselines are arguably more problematic than the impacts of too stringent crediting baselines: both too lenient and too stringent crediting baselines can decrease the cost efficiency, while too lenient baselines also have adverse impacts on achieving GHG emission goals. the cost whereas costs of global costs, whereas. Since the true BAU emissions level is not known and associated with uncertainty, this suggests that setting crediting baselines at a conservative level below the most likely BAU seems a reasonable approach in balancing negative environmental and economic impacts. Moreover, the clear agreed global preference for market mechanisms is to lead to a net decrease rather than a net increase of GHG emissions.

4.4. ADDRESSING UNCERTAINTY: OPTIONS AND LIMITATIONS

The uncertainty in the quantification of BAU emissions can, to some extent, be addressed through the choice of an appropriately conservative crediting baseline. Figure 1 illustrates an example for the selection of a conservative crediting baseline. The figure shows for both the BAU emissions and the actual emissions the most likely estimate and the uncertainty band. The uncertainty of BAU emissions is deemed to increase with more distant time projections in the future (see section 4.3 above). For the monitoring of actual emissions the uncertainty is assumed to be lower and not to increase over time. For many sectors, such as fuel combustion or electricity generation, the uncertainty associated with monitoring actual emissions is not very large and does not increase over time if the same monitoring methods are consistently applied. Note that in some sectors, such as agriculture, monitoring actual emissions can also be associated with significant uncertainty.

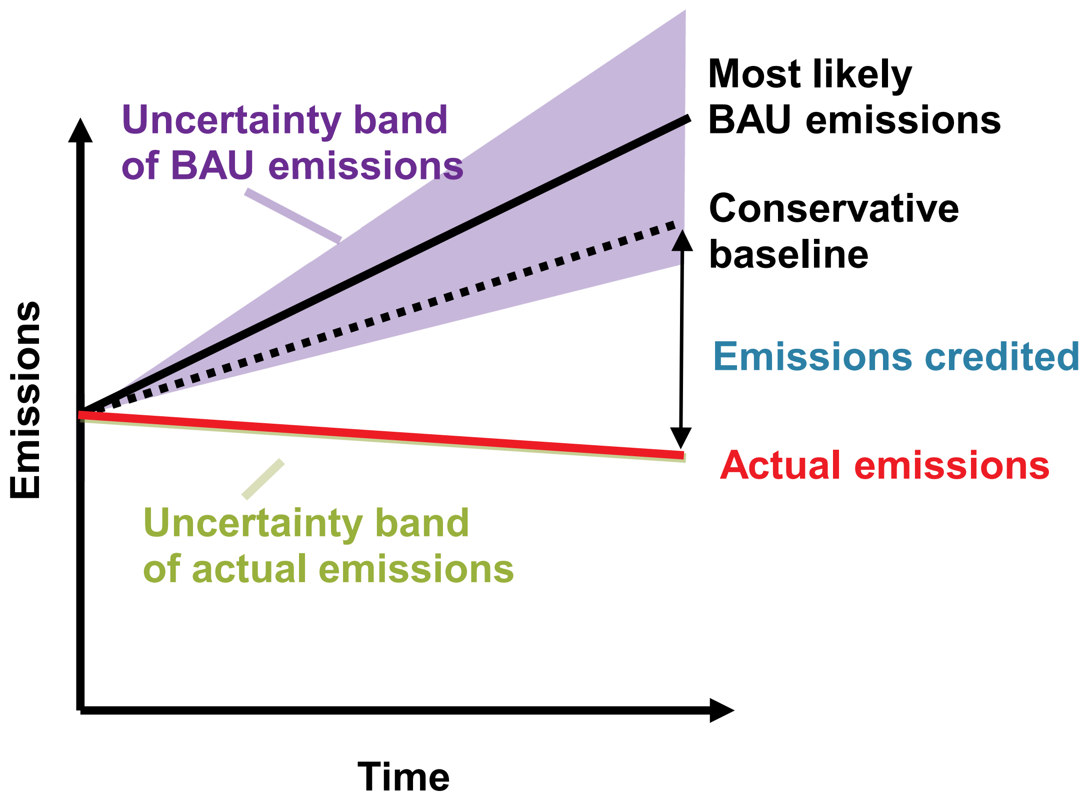

Figure 1 Addressing uncertainty through conservative crediting baselines

To address the uncertainty, the crediting baseline could be conservatively set below the most likely BAU emissions level. In the figure, the crediting baseline is set in between the most likely BAU development and the lower end of the uncertainty band. The conservatively set crediting baseline would reduce the amount of credits to some extent but would still enable a significant amount of the emission reductions to be accounted, thereby providing incentives for the entities under the mechanism to achieve the envisaged emissions level.

Uncertainty in the BAU emission level becomes particularly relevant where the difference between baseline and actual emissions is small in comparison to the uncertainty associated with the baselines emission. This issue is also referred to as "**signal-to-noise problem**" and illustrated in Figure 2.

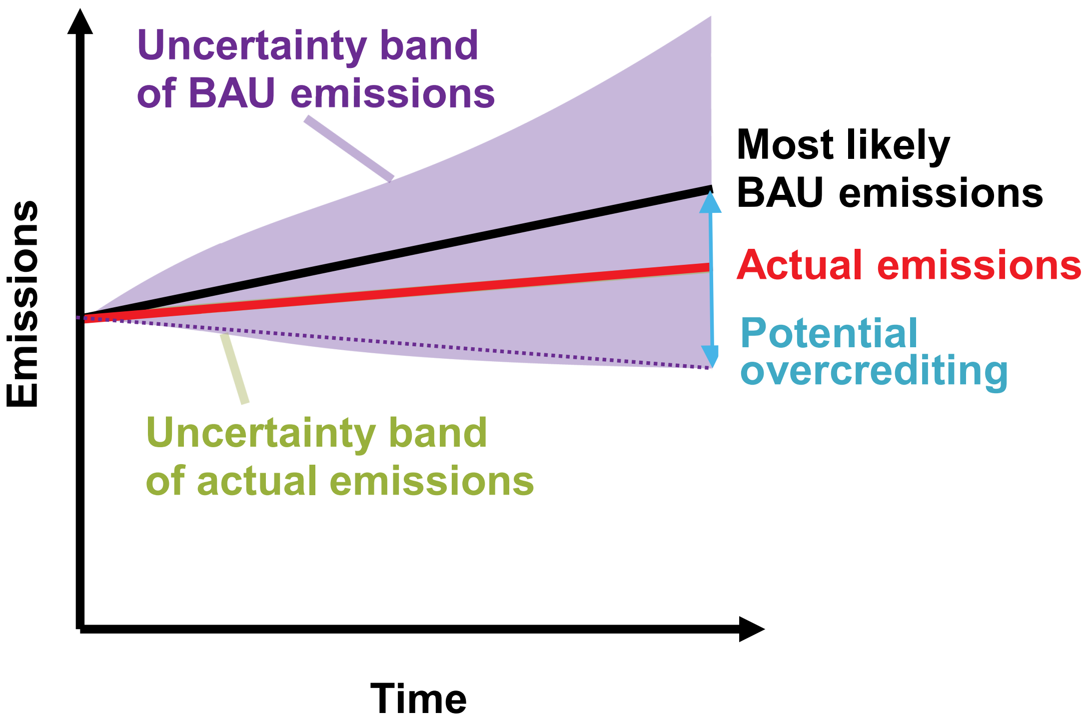

Figure 2 Signal-to-noise problem

In **Figure 2** the uncertainty of the baseline emissions is significantly larger than the envisaged emission reductions. This poses the risk that an erroneously defined crediting baseline could result in significant over- or under-issuance of credits. If the real BAU emissions in **Figure 2** would be at the upper end of the uncertainty band, only about one third of the emission reductions would be issued as units. If the real BAU emissions would be at the lower end of the uncertainty band, no real emission reductions are achieved and all of the credits would not represent real emission reductions. This example shows that the approach of selecting crediting baselines in a conservative manner to address uncertainty has limitations. In addition, in practice the uncertainty of BAU emissions is not necessarily distributed symmetrically around the most likely scenario. In conclusion, it can be impossible to determine a robust crediting baseline that would still provide incentives to reduce emissions in cases of a high uncertainty of BAU emissions.

This shows that evaluating the uncertainty of BAU emissions is key for ensuring cost-effectiveness and robustness of a crediting mechanism. We recommend that the analysis presented in **Figure 2** be conducted for crediting baselines that are used for large volumes of emission reductions, in particular any sector based or policy based crediting mechanisms. The analysis also indicates that a crediting mechanism may not be a suitable instrument in situations where a signal-to-noise problem persists due to either highly uncertain future developments or the lack of consistent and robust data.

4.5. UPDATE OF CREDITING BASELINES

The way and frequency at which crediting baselines are updated is a key methodological and policy choice which needs to balance two opposing objectives: providing for investor certainty and ensuring that crediting baselines continue to be robust over time. Less frequent updates provide higher certainty for investors. However, the uncertainty whether the crediting baseline appropriately reflects BAU emissions or is below BAU emissions increases over time. Assumptions made when estimating BAU emissions and deriving the crediting baseline may not be valid anymore. This can have different effects: a too lenient crediting baseline may result in over-crediting; a too stringent crediting baseline may reduce the incentives for investors to continue to abate GHG emissions. The frequency of updating the crediting baseline is also related to the choice for the length of the crediting period. With short crediting periods it may not be necessary to update the crediting baseline. With long crediting periods, updating crediting baselines becomes more important to ensure that the crediting baseline is still robust and reasonable.

A crediting baseline is usually derived from different types of data and information. Table 8 below provides an overview of the type of data and information that is typically required for setting crediting baselines. In practice, all of the data and information could be re-assessed and updated at one point in time or the data is updated at different points in time.

Type of data and information	Examples	Indicative frequency for updating
General sector / technology data	Current costs and performance of technologies used in the sector (e.g. used for cost comparison) Current market penetration of technologies (e.g. used to identify a reference technology) Assumptions made on future policies, market prices, availability and innovation of technologies, fuel availability, etc	3-10 years 1-10 years 3-10 years
Models / equations used to calculate baseline emissions	Macro-economic model of the energy sector First order decay model to quantify methane generation from landfills	3-10 years 3-10 years
Activity data	Electricity production Gross Domestic Product (GDP)	*Ex-post* monitoring / 3-10 years *Ex-post* monitoring / 3-10 years
Other parameters required to quantify baseline emissions	Net calorific values (NCVs) and CO_2 emission factors of fuels GWPs Heating degree days, expressing the influence of outside temperature on heating demand	*Ex-post* monitoring / 3-10 years According to UNFCCC "commitment periods" *Ex-post* monitoring

Table 8 Data and information typically required for setting crediting baselines

In practice, some data and information may be continuously monitored *ex-post*, while other data and information may be updated at pre-determined intervals. Hence, there are multiple approaches towards updating the crediting baseline, depending on which type of data and information is updated at which points in time. This is illustrated in the following possible approaches towards updating crediting baselines:

› **Pre-determined absolute crediting baseline.** The crediting baseline is expressed in an absolute amount of tonnes of CO_2 equivalent for each year of the crediting period and is not changed until its update. At the update, all four categories of information and data in Table 8 above are re-assessed, and a new crediting baseline is developed for the subsequent period, taking into account the updated data.
› **Pre-determined intensity crediting baseline.** The crediting baseline is expressed as an intensity rate or emission factor, such as tonnes of CO_2 equivalent per Gross Domestic Product (GDP) or tonnes of CO_2 equivalent per unit of production (e.g. t CO_2 / kWh electricity or t CO_2 / t clinker). The activity level is monitored *ex-post* during the crediting period and multiplied with the pre-determined intensity rate or emission factor to quantify *ex-*

post the absolute emission level of the crediting baseline. For example, in the case of a sector based crediting mechanism in the cement sector the baseline emission factor could be pre-determined for 5-10 years and then be multiplied with the *ex-post* monitored amount of cement production in the industry. The pre-determined intensity rate or emission factor could either be a constant value for all years or a set of values for each year of the crediting period in order to reflect trends in the sector. However, in both cases the values are pre-determined for the entire crediting period and are only updated for subsequent crediting periods. At the update, all four categories of information and data in Table 8 above, except for the activity data, are re-assessed, and a new crediting baseline is developed for the subsequent period, taking into account the updated data.

› **Dynamic crediting baselines.** The crediting baseline is expressed as an algorithm or a model. Both the activity data and some parameters are monitored *ex-post* or updated at regular intervals. The absolute emission level of the crediting baseline is determined *ex-post*, by applying the monitored or updated data in the algorithm or model. For example, for a sectoral programme to promote wind power, both the wind power generation as well as the grid emission factor for the electricity system could be monitored and determined *ex-post*. The absolute emission level of the crediting baseline is then calculated *ex-post* by multiplying the monitored wind power generation with the monitored grid emission factor. Dynamic crediting baselines allow for a variety of approaches in which different data and information is re-assessed at different paces. Some parameters may be pre-determined until the update of the crediting baseline, while others may be continuously monitored or updated at more frequent intervals. For example, the updating of GWP values could not be linked to the frequency of updating other parameters but to the length of "commitment periods" under UNFCCC. Most CDM methodologies apply dynamic crediting baselines. In the case of dynamic crediting baselines, the update would mainly involve a re-assessment of the general sector and technology data, the models and equations used to calculate baseline emissions, and possibly some parameters which were pre-determined for the entire crediting period.

Current crediting mechanisms apply either pre-determined intensity or dynamic crediting baselines. All CDM methodologies monitor activity levels ex-post and most CDM methodologies apply dynamic crediting baselines. Key parameters for the emission reduction calculation are often pre-determined for the crediting period, while strongly varying parameters are usually monitored ex-post. This allows estimating baseline emissions in a more robust manner while still providing a high degree of predictability to investors. However, under the CDM, sector and technology data is not used to re-assess whether the baseline scenario is still valid at the renewal of the crediting period which poses a considerable risk that crediting baselines in second and third crediting periods are not robust.

The most appropriate methodological choice depends on a number of factors, such as the type of mechanism, the characteristics of the sector and the uncertainty of the BAU emissions. Therefore, the approach towards updating should be specific to the sector and mechanism. Table 9 summarizes key advantages and disadvantages of the different approaches.

Pre-determined absolute crediting baselines at sectoral level allow crediting all activities which reduce GHG emissions in the installations covered under the sector. In the power sector, a pre-determined absolute crediting baseline would allow to credit measures to reduce the GHG intensity of power generation, such as the promotion of renewable power, energy efficiency improvements at power plants, or the use of less carbon intensive fuels, as well as measures to reduce power demand, such as demand-side energy efficiency measures. Similarly, in the steel sector credits would not only be awarded for measures which reduce the GHG intensity of steel production but also measures which reduce steel demand. This is not the case for pre-determined intensity and dynamic crediting baselines for which the scope of GHG abatement options to be credited is limited to measures that reduce the GHG intensity of production. In this regard, for sectors with a huge demand-side potential, pre-determined absolute crediting baselines offer a greater potential, as long as all installations in the sector are included within the scope of the mechanism.

Pre-determined absolute crediting baselines are also more suitable when combined with a domestic emissions trading scheme (ETS). In this case, emissions reductions below the cap of the ETS could be credited and sold under an international crediting mechanism. The crediting baseline could correspond to the cap of the ETS or set at a more ambitious level. In contrast, pre-determined intensity or dynamic crediting baselines could *ex-post* result in levels that are less ambitious than the cap of the ETS in which case the credits would not represent emission reductions beyond the efforts achieved through the cap of the ETS. Another potential advantage of pre-determined absolute crediting baselines, in particular if derived from pledges, is that they provide more certainty whether the overall emission baselines and pledges result in an ambition level that is consistent with the 2°C target. In the case of pre-determined intensity or dynamic crediting baselines the achievement of sufficient global ambition would depend on future development of the factors underlying the intensity or dynamic crediting baseline. The most important disadvantage is that pre-determined absolute crediting baselines depend more heavily on assumptions on future developments and hence involve a greater uncertainty. Unforeseen developments, such as a recession, a technological break-through or fuel price changes, could result in considerable over- or under-crediting, whereas intensity and dynamic crediting baselines allow, to some extent, to factor out such developments, adjusting the crediting baseline *ex-post* accordingly. Pre-determined absolute crediting baselines are therefore less appropriate in sectors with considerable uncertainty regarding future developments.

Type of crediting baseline	Example	Advantages	Disadvantages
Pre-determined absolute crediting baselines	Absolute level set at the cap of a domestic ETS	Sector based mechanism: Allow to credit all GHG abatement options available in the sector Sector based mechanism: Combination with emissions trading schemes (ETS) is straightforward Certainty on the absolute emissions level and therefore more certainty for investors	Uncertainty: larger risk for over- or under-crediting as unexpected developments are not factored out
Pre-determined intensity crediting baselines	Renewable power projects with a fixed grid emission factor for one crediting period	Reflect unexpected developments in the parameter used for the intensity, thereby partially addressing uncertainty (e.g. different GDP growth, less wind power generation due to seasonal changes)	The absolute emissions level is only known *ex-post* Scope is limited to reducing GHG intensity
Dynamic crediting baselines	Avoided CH_4 emissions from landfilling waste, determined ex-post through a first order decay model	Allow for more robust crediting baselines and partially address uncertainty by factoring out the influence of parameters that are not affected by the mechanism (e.g. varying weather conditions, GDP growth)	The absolute emissions level is only known *ex-post* and therefore less certainty for investors Scope for GHG abatement measures could be more limited

Table 9 Advantages and disadvantages of different types of crediting baselines

4.6. CONSIDERATION OF THE REGULATORY FRAMEWORK IN SETTING CREDITING BASELINES

The regulatory and policy framework in the country hosting a crediting mechanism significantly impacts the future GHG emissions pathways. This holds for policies that aim at reducing GHG emissions as well as policies implemented for other policy objectives. For example, fossil fuel subsidies have a significant impact on the viability of less GHG intensive technologies; air quality regulations for power plants impact their CO_2 emissions; and energy efficiency standards for household appliances significantly impact power sector emissions. Whether and how such policies should be considered in setting and updating crediting baselines has been a controversial topic since the establishment of crediting mechanisms.[11] Indeed it is difficult to reconcile two divergent policy objectives: ensuring robust crediting baselines and avoiding perverse incentives for policy makers.

A crediting baseline is considered robust if it is set at or below the most likely BAU emissions level (see section 4.3 above). Given that policies and regulations affect GHG emissions, they should generally be considered in setting crediting baselines. This principle is, for example, acknowledged in the modalities and procedures for the CDM.[12]

For **project based crediting mechanisms**, however, the consideration of policies could create perverse incentives for policy makers not to adopt policies that lower GHG emissions or not to abandon existing policies which increase GHG emissions, if such action would lower the potential for credit generation. For example, regulations which require the capture of methane from landfills would make this project type BAU. Similarly, feed-in tariffs for renewable electricity generation could lower the potential from such project types. The removal of fossil fuel subsidies could make low GHG technologies economically viable and thereby limit the potential for credits from such projects.

To address such perverse incentives in the CDM, the CDM Executive Board adopted regulations which require market participants to:

› disregard policies adopted after 1997 which "give comparative advantages to more emissions-intensive technologies or fuels over less emissions-intensive technologies or fuels" (referred to as E+ policies) in setting the baseline, and
› disregard policies adopted after 2001 which "give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies" (referred to as E- policies) in setting the baseline.[13]

This regulation aims to avoid perverse incentives for policy makers to introduce policies which increase GHG emissions (E+ policies) or not to adopt policies which lower GHG emissions (E- policies). However, the approach under the CDM does only partially avoids perverse incentives for policy makers. Policy makers would still have perverse incentives to keep existing E+ policies in place, such as fossil fuel subsidies. Another concern is that the approach towards E- poli-

[11] For an overview, see Spalding-Fecher 2013
[12] See paragraph 45(e) of decision 3/CMP.1
[13] See annex 3 to the meeting report of the 22nd meeting of the CDM Executive Board

cies is likely to result in lenient crediting baselines above the BAU level. This poses a dilemma which appears impossible to solve for project based mechanisms. For E- policies, the two policy objectives, ensuring robust crediting baselines and avoiding perverse incentives, cannot both be achieved at the same time but only be balanced.

In balancing the two policy objectives, it is important to assess the potential risks from either lenient crediting baselines or perverse incentives and their relative magnitude. If the risk of perverse incentives is deemed significantly larger than the risk of lenient crediting baselines, E-policies may (for a certain period) not be considered in setting the crediting baseline. Vice versa, E- policies should be considered in setting the crediting baseline if the risks from lenient crediting baselines are deemed larger than the risks of creating perverse incentives for policy makers. The result of this assessment may depend on the sector, project type and type of policy. Many policies are driven by policy objectives not directly related to climate change, such as economic growth, diversification of the economy or power sector, safety and human health. This holds, for example, for air pollution regulations, safety regulations or some energy efficiency standards. In such cases, the risk is lower that policy makers would not adopt such policies due to an international crediting mechanism. This may be different for policies which only or mainly aim at reducing GHG emissions, such as regulations to capture HFC-23 or N_2O from adipic or nitric acid production. Given the significant co-benefits of many E- policies, it seems likely that for many E- policies the risk of creating perverse incentives may be lower than the risks from lenient crediting baselines.

A considerable practical challenge is the assessment of the risk related to perverse incentives for policy makers. Methodological approaches to assess the risk do not exist so far and there is no literature which assesses in a systematic manner whether and to what extent such risks exist. A possible approach for assessing the risks for perverse incentives for policy makers could be an assessment to what extent the relevant policies generate other co-benefits and to what extent the adoption of such polices would result in loss of revenues from the crediting mechanism.

Another practical challenge is that it could in many cases be methodologically very difficult to disregard certain policies when setting the crediting baseline. Often, numerous policies which may impact GHG emissions apply in one sector. Disregarding some of these policies would require constructing a highly hypothetical sector model to assess the economic viability of different technologies and assess their GHG emissions.

Based on this analysis we recommend the following approach for project based crediting mechanisms:

- As a general rule, **E- policies** should be considered for most sectors in setting and updating the crediting baseline. In our judgment, for E- policies the risks of creating perverse incentives is likely to be lower than the risks from lenient crediting baselines. In addition, this approach avoids considerable practical methodological challenges. However, exceptions to this rule should apply if it does not lead to a reasonable balance between the two policy objectives for specific sectors. In providing for exemptions, one approach could be to exclude E- policies on a temporary basis or after a certain period.
- As a general rule, **E+ policies** that have considerable impact on GHG emissions and pose high risks for perverse incentives, such as fossil fuel subsidies, should be disregarded in setting the crediting baseline, irrespective of when they were adopted. Again, exceptions may be needed: E+ policies that are introduced to address health or environment issues which are important for a sustainable development could be included in setting the crediting baseline. For example, air pollution control at coal power plants reduces the efficiency of coal power plants to some extent and hence increase GHG emissions. Regulations to reduce air pollutants from coal power plants could therefore be regarded as an E+ policy. The inclusion of this policy in baseline setting reflects actual emissions and avoids perverse incentives for policy makers not to introduce such regulations.

The dilemma between the two policy objectives of ensuring robust crediting baselines and avoiding perverse incentives for policy makers is also relevant for **sector based crediting mechanisms**. A key question is whether existing and planned policies should be taken into account in setting the sectoral crediting baseline. With regard to E- policies, the following approaches could be taken:

- **No consideration of E- policies:** If both existing and planned E- policies are not considered in setting the crediting baselines, the crediting mechanism would not create perverse incentives not to introduce E- policies in advance or after the starting of crediting. On the contrary, the host country would have incentives to introduce further E- policies as they would increase the potential for credits. However, the baseline would likely be inflated above the most likely BAU emissions that would occur in the absence of the crediting mechanism.
- **Consideration of existing E- policies, exclusion of future E- policies:** In setting the crediting baseline, a cut-off date could be used in order to consider already adopted and exclude future E- policies. The cut-off date could be set politically at a certain date or could be re-

lated to the finalization of the baseline setting process. Selecting an appropriate cut-off date is not straight-forward: a late point in time could be disadvantageous for "early mover" countries that already introduced several E- policies. Vice versa, an early date may potentially inflate the crediting baseline because it could result in the crediting of already adopted E- policies. Moreover, the exclusion of any planned policies in the baseline setting implies that any future policies reducing GHG emissions in the sector will implicitly be credited. Hence, it is implicitly assumed that the country would, in the absence of the crediting mechanism, never again adopt E- policies – which seems a questionable assumption that could lead to baselines above the most likely BAU emissions level in the absence of the crediting mechanism. On the other hand, this approach provides positive incentives for policy makers to adopt E- policies; once the crediting baseline is set, any further E- policies would increase the potential for crediting.

› **Consideration of existing and future E- policies:** In setting the crediting baseline, both existing and future E- policies are considered. To reflect future E- policies in the crediting baselines, either planned policies could be considered ex-ante or the crediting baseline could be updated after the adoption of relevant policies. The latter approach may provide for a more accurate reflection of the impacts of E- policies, since it is often uncertain whether planned policies will be implemented and not all future E- policies can be foreseen when establishing the crediting baseline. While this option ensures robust crediting baselines, it could create disincentives to introduce E- policies, as their introduction could lower the potential for credits. It would also provide greater uncertainty for investors as to when a crediting baseline will be updated.

The exploration of these options shows that the two policy objectives are also challenging to reconcile for sector based crediting mechanisms. To avoid a significant overestimation of crediting baselines, it seems reasonable to consider the impact of already adopted E- policies in the crediting baseline. A more difficult question is how future E- policies should be taken into account. How to best address future E- policies would need further exploration.

As for project-based mechanisms, this dilemma does exist for E+ policies. The exclusion of E+ policies in setting the crediting baseline results in a more conservative crediting baseline and avoids any disincentives for policy makers to abandon such policies.

The issue of E- and E+ policies is also discussed in Part II of the study from a different angle in the context of country pledges, an approach that may help to (partly) overcome the challenges identified here.

5. ADDITIONALITY ASSESSMENT

Additionality refers to the question whether the emission reductions occur as a result of the crediting mechanism or whether they would have occurred anyway. Ensuring additionality is key for the integrity of crediting mechanisms. If the emission reductions would occur also in the absence of the crediting mechanism (e.g. due to existing and enforced legislation), the issuance of units would undermine the integrity of the system: the use of the units would enable other entities to increase their GHG emissions, whereas no actual emission reductions occurred as a result of the mechanism. For this reason, paragraph 79 of decision 2/CP.17 requires that "various approaches (...) must meet standards that deliver (...) *additional* (...) mitigation outcomes". Similarly, paragraph 51 of decision 1/CP.18 makes reference to "standards that deliver (…) additional (…) mitigation outcomes" in the context of the NMM.

Approaches for ensuring additionality have been widely and controversially discussed in the context of project-based crediting mechanisms, to some extent for sector market based mechanisms, and to a much lesser extent for policy based crediting mechanisms.[14] In the following, we first provide an overview of approaches used for testing additionality in project-based crediting mechanisms, briefly discuss their advantages and disadvantages, and draw conclusions with regard to their suitability to achieve the objective to deliver additional mitigation outcomes (section 5.1). Based on the lessons learned from the approaches for project based crediting mechanisms, we then discuss possible approaches for sector based crediting mechanisms (section 5.2) and policy based crediting mechanisms (section 5.3).

5.1. PROJECT BASED MECHANISMS

A variety of approaches are used for assessing additionality in project based and programmatic GHG offsetting programmes. In many instances, different approaches are combined through a step-wise procedure which leads to a final conclusion whether a proposed project or programme is deemed additional and thus eligible for crediting. Table 10 provides an overview of the approaches deployed so far and proposed in the literature. In the following, we summarize and briefly discuss the approaches.

[14] See, for example: Schneider (2009)

<table>
<tr><th>Approach</th><th>Description</th><th>Examples of suitable sectors / project types</th><th>Key issues</th></tr>
<tr><td colspan="4">1) Prior consideration: Demonstration that the project considered the incentives from the crediting mechanism when proceeding with the investment</td></tr>
<tr><td>Notification letter</td><td>A third party institution (e.g. UNFCCC) is informed about the intent to generate credits</td><td>All</td><td>Timing of notification (before or after project start)</td></tr>
<tr><td>Internal documentation</td><td>Internal documentation shows intent to generate credits</td><td>All</td><td>Information asymmetry between project developers and verifiers / regulators</td></tr>
<tr><td colspan="4">2) Investment analysis: Demonstration that a project is economically not attractive without credit revenues</td></tr>
<tr><td>Investment comparison analysis</td><td>Comparison of the economic attractiveness of different investment alternatives</td><td>Investment alternatives are mutually exclusive, e.g. retrofit of existing plants</td><td rowspan="2">Assumptions on input parameters
Determination of the financial benchmark
Information asymmetry between project developers and verifiers / regulators
Consideration of subsidies
Comparability of investment alternatives
Assessment whether the project becomes economically attractive with credit revenues</td></tr>
<tr><td>Benchmark analysis</td><td>Comparison of the economic performance of the project with a financial benchmark</td><td>Project types where economic performance varies among projects, e.g. large hydro power</td></tr>
<tr><td>Simple cost analysis</td><td>Demonstration that the project does not save costs or generate other revenues than credit revenues</td><td>HFC-23
N_2O from nitric acid</td><td></td></tr>
<tr><td colspan="4">3) Barrier analysis</td></tr>
<tr><td>Barrier analysis</td><td>Demonstration that a project faces barriers which prohibit its implementation without credit revenues</td><td>Project types which are economically attractive but commonly not implemented due to barriers to investment, e.g. energy efficiency measures</td><td>Subjectivity whether barriers prohibit projects from being implemented
Subjectivity whether the credits overcome barriers
Information asymmetry between project developers and verifiers / regulators</td></tr>
<tr><td colspan="4">4) Market penetration rates or common practice analysis</td></tr>
<tr><td>Market penetration rates or common practice analysis</td><td>Demonstration that the project type has a low market penetration and is thus not common practice</td><td>Innovative technologies that still need to diffuse in the market, e.g. LED lamps</td><td>Limitations in the causality between low market penetration and likelihood of additionality
Definition of "technology" and the peer group
Definition of the geographical boundary for the assessment
Policy choice of the threshold which impacts the number of</td></tr>
</table>

Approach	Description	Examples of suitable sectors / project types	Key issues
			"false positives" Availability of reliable data
5) Positive lists, negative lists, eligibility criteria and decision trees: Definition of technologies that are likely to be additional or not additional			
Positive lists	A project type is deemed automatically additional	Project types with very high likelihood of additionality	Methodologies and guidelines used to derive positive lists Consistency in approaches Availability of reliable data Regular update of positive lists Number of "false positives"
Negative lists	A project type is deemed not additional	Project types with low likelihood of additionality	Methods used to derive negative lists
Eligibility criteria / decision trees	A projects is deemed additional if it satisfies one or several conditions	Project types where additionality depends on key parameters (e.g. size, location, technological design)	Methods used to derive eligibility criteria / decision trees Similar to positive/negative lists Number of "false positives"
6) Emission benchmarks			
Emission benchmarks	Comparison of the GHG performance of the project with an emissions benchmark	Project types with homogenous outputs (e.g. grey cement clinker) and for which low GHG performers are likely to be additional	Limitations in the causality between low market penetration and likelihood of additionality Policy choice of the threshold which impacts the number of "false positives" Choice of the level of aggregation Availability of reliable data Frequency of updates of the emissions benchmark
7) Impact analysis			
Impact analysis	Assessment of the extent to which credit revenues change the economic attractiveness	All, including public sector	Policy choice of the thresholds for the impact and the credit prices assumed Assumptions on input parameters Consideration of subsidies

Table 10 Overview of methodological approaches for assessing additionality of projects

Prior consideration: A number of multilateral or governmental support programmes involving subsidies or funding include provisions that aim to ensure that only projects are eligible which were aware of the programme when the decision was made to proceed with the investment. In many cases it is required that the project had not yet started or been installed before the subsidy or funding is requested or granted. This requirement aims to reduce the number "free-riders" by considering projects ineligible which went ahead without the subsidy or funding. A similar approach is implemented in most but not all GHG offsetting programmes. Under the CDM, project developers have to provide written evidence that the CDM was known to them when proceeding with the investment. Since 2008, project developers need to notify the UNFCCC secretariat of the intent to seek CDM registration within six months after the start of a project. This requirement does not apply to programmes of activities and afforestation and reforestation projects. Under JI, prior consideration is not required. Generally, the requirement of "prior consideration" can be implemented easily through a simple notification procedure, such as under the CDM, and involves very low transaction costs. It ensures that projects cannot claim credits retroactively for activities that were started in the past. It is thus an important means to screen out projects that are very unlikely to be additional.

Investment analysis: Investment analysis is often used to demonstrate additionality. The investment analysis compares the economic attractiveness of different investment alternatives or compares the financial performance of a proposed project with a financial benchmark. A project is deemed additional if it is not the economically most attractive course of action among different investment alternatives or if it is not economically profitable without revenues from the carbon market. A key advantage of the investment analysis is that, if applied correctly, it is able to reflect the specific circumstances of a proposed project. This is particularly important in the case of project types with strongly differing costs that depend on the specific circumstances of the project. However, investment analysis has been criticised for its subjectivity and its vulnerability to fraudulent statements. The results of the investment analysis heavily depend on assumptions made in the selection of input parameters, such as *ex-ante* estimations of capital expenditure or future fuel prices, which are difficult to assess in an objective manner and which are associated with considerable uncertainties. The investment analysis is also prone to fraudulent statements, e.g. through the omission of information, such as tax benefits. Both unreasonable assumptions on costs and revenues and fraudulent statements may be difficult to detect due to the information asymmetry between project developers and verifiers.

Barrier analysis: Barrier analysis is often used as an alternative or as a complement to the investment analysis. The barrier analysis is used to demonstrate that a project faces barriers which impede the project from being implemented in absence of the incentives from the GHG offsetting programme. The barrier analysis is often regarded as even more subjective than the investment analysis. A key challenge is that every investment project faces some barriers and it is very difficult to assess objectively whether barriers are prohibitive to implement a project.

Another concern is that it is often unclear how the GHG offsetting programme can alleviate or overcome such barriers.

Market penetration rates or common practice analysis: Some standards and programmes apply market penetration rates or common practice analyses to demonstrate additionality. This approach aims to assess to what extent a project type or technology is already being implemented in the host country. It is assumed that a low market penetration indicates a higher likelihood that the project is additional. In some cases, market penetration approaches are also used to confirm that the identified baseline scenario is actually frequently implemented and thus a realistic scenario. Common practice analysis often complements the investment or barrier analysis. Key challenges of the common practice analysis are the definition of what is regarded a comparable technology, what is the appropriate geographical boundary for assessing common practice and what market penetration threshold should be used to regard a technology common practice. In many sectors it is difficult to provide meaningful definitions and thresholds which reliably assess the likelihood that a project is additional. More fundamentally, the market penetration of technology is not always related to the likelihood of additionality. For example, a technology could have only a small potential, e.g. due to geographical circumstances, but the few projects that are implemented could be economically highly attractive. Another criticism with regard to the common practice analysis under the CDM is that project developers can claim that a frequently implemented technology is not common practice if they can justify differences to other similar projects. However, the criteria under which circumstances a project is considered different are not clearly specified.

Positive lists, negative lists, eligibility criteria and decision trees: Positive lists are commonly referred to as project types which are deemed automatically additional. Negative lists refer to project types which are not deemed additional. Positive and negative lists can be established globally or for specific countries or regions within a country. When established globally, a specific technology is regarded as automatically additional or not additional, independent of the host country of the project. For example, CDM methodologies consider project types with no other revenues than credits often as automatically additional, such as N_2O abatement from nitric acid production or HFC-23 abatement from HCFC-22 production. Under the CDM, global positive lists are also used for micro-scale projects with high GHG abatement costs. Negative lists can be established based on additionality considerations or based on other motivations. Parties to the Kyoto Protocol agreed to exclude nuclear power from the CDM and to limit projects in the forestry sector to afforestation and reforestation, thereby excluding activities such as reducing emissions from deforestation or forest management.[15] In addition, international aviation and maritime emissions are excluded from the scope of the Kyoto Protocol and thus also not eligible project types under the CDM. The CDM Executive Board explicitly excluded some further project types from the CDM, including:

- Hydro power plants with a reservoir surface in relation to the power generation capacity of less than 4 W / m^2, due to the uncertainty of size of methane emissions from such reservoirs[16],
- Transfer of know-how and training[17], and creating infrastructure (e.g. testing labs, creation of an enforcement agency) or capacity to enforce a policy or standard[18], due to concerns whether the quantified emission reductions are fully attributable to such activities, and
- Extinguishment of coal field fires[19], due to concerns that the emission reductions may only be temporary and not permanent.

In addition, any project type for which a baseline and monitoring methodology is not available is implicitly excluded from crediting, as long as an applicable methodology is not approved. For some project types, proposed methodologies have repeatedly been rejected due to concerns over the integrity of the emission reductions. This holds, for example, for "avoided fuel switch" projects that continue to use a low carbon fuel and claim that they would switch to a more carbon intensive fuel type without carbon market revenues.

Positive or negative lists for specific regions or countries are usually derived based on a set of criteria or an assessment of the specific situation of the project type in the region or country. This sometimes includes the assessment of different indicators or a procedure or decision tree that aims to take the specific circumstances in the host country into account. In some cases, positive lists are derived based on the typical costs of the project type and the impact of credits on the economic feasibility. Under programmes of activities (PoAs) in the CDM, project developers can establish simplified eligibility criteria to assess the additionality of individual activities that are included in the programme. Under the CDM, the "Guidelines for the establishment

[15] See for further clarification on the implementation of this provision: Report of the 20th meeting of the CDM Executive Board, Annex 8
[16] Approved baseline and monitoring methodology ACM0002
[17] Report of the 23rd meeting of the CDM Executive Board, paragraph 80
[18] Report of the 33rd meeting of the CDM Executive Board, paragraph 30
[19] See proposed new methodology NM0267 "Shuixi Gou Coal Field Fire Extinguishing Project"

of sector specific standardized baselines" are used to establish country specific positive lists of technologies.

Positive and negative lists are objective criteria for project eligibility. Their robustness depends on how they are derived. Also, the parameters underlying the inclusion of a project type in positive or negative lists change over time. Therefore, positive and negative lists need to be updated on a regular basis. To provide for investor certainty, an update of positive and negative lists commonly only applies to new projects, not affecting already approved projects. Under the CDM, positive lists derived from standardized baselines are valid for three years.

Emission benchmarks: A number of standards and programmes use GHG emission benchmarks to assess additionality. A project is deemed additional if its GHG performance is better than the benchmark. The underlying assumption of this approach is that projects with a low GHG intensity are often more costly or difficult to implement and are thus more likely to be additional. Setting the ambition of the emission benchmarks is a key policy choice. More ambitious benchmarks tend to provide a higher likelihood that the projects that qualify are additional; however, they also reduce the number of projects that qualify and thus the potential from the crediting mechanism. Vice versa, more projects qualify under more lenient benchmarks; however, a larger fraction of these projects may not be truly additional.

Emission benchmarks have the advantage that they provide a more objective method of assessing project additionality, compared to the investment analysis and barrier analysis. However, they are often difficult to establish in practice due to the lack of reliable sector wide data on GHG emissions intensity or due to the confidentiality of such data. Other challenges include selecting the most appropriate aggregation level for the emission benchmarks, the consideration of specific local circumstances, such as the availability of fuels and raw materials, and the updating of the benchmarks in sectors where the GHG emissions intensity can vary significantly over time. A high GHG emission performance is also not in all sectors a good proxy for assessing additionality; in some sectors, less GHG intensive technologies and fuels may be economically more attractive.

Impact analysis: This approach assesses whether the incentives from the crediting mechanism (e.g. the revenues from credits) significantly impact the economic feasibility of a project. This approach assumes that the likelihood that a project is additional is correlated to the impact of the credit revenues on its economic feasibility, or in other words, if the credits "make a difference" for the investment decision. It is argued that, for example, for a project with an internal rate of return (IRR) of 8.5% without credit revenues and 8.7% with credit revenues it is relatively unlikely that the credit revenues played a key role in the decision to proceed with the project, because the size of the credit incentive is much lower than typical uncertainties in investment cost parameters. In contrast, for projects which are very unattractive without credit revenues (e.g. an IRR of 3%) and highly attractive with credit revenues (e.g. an IRR of 20%) it assumed likely that the credit revenues play a key role in making the investment decision. The approach could be used to assess the additionality of projects individually or to derive positive and negative lists. The latter has also been referred to as a "probabilistic" approach towards additionality testing. This approach still relies on input parameters on costs and revenues but is nevertheless less subjective than the investment analysis, because the *relative* change in the IRR due to credit revenues depends strongly on the amount of emission reductions achieved and is less sensitive to input data in the investment analysis.

Impact analysis may be especially useful in a project context where investment decisions are not taken on the basis of purely financial considerations (which is an key assumption of the investment analysis approach), but where other factors are dominant. E.g. existing public sector investments in public transport systems are not profitable in most cases in the sense that the costs are higher than the revenues. Still public sector entities invest in public transport in order to improve the economic and environmental conditions. Therefore, an impact analysis is used in the current versions of large scale transport sector CDM methodologies[20]: Here, projects by non-commercial entities (i.e. from the public sector) have to demonstrate that revenues from CERs per year are significant compared to operating & maintenance costs.

The overview illustrates that all approaches have merits but also face considerable challenges. Indeed, establishing robust approaches to assess additionality is the biggest challenge for project based and programmatic GHG offsetting mechanisms. All approaches involve "free-riders", to a varying extent. Several studies identified problems with approaches that rely on subjective assessments by the project developers, such as the barrier analysis and investment analysis.[21] As a result, many stakeholders called for more objective and robust approaches. For example, the CDM Policy dialogue called for an increased use of standardized approaches, such as performance benchmarks, in the assessment of additionality, moving away from more subjective and unverifiable financial additionality tests (CDM Policy Dialogue 2012). These standardized tests, e.g. positive lists, emission benchmarks and market penetration rates, may provide a more objective way to assess additionality and rely less on information from project developers that is dif-

[20] Large scale CDM methodologies in transport sector with impact analysis: Bus Rapid Transit (AM0031, v5.0), Mass Rapid Transit (ACM0014, v 3.0) and High Speed Passenger Rail Systems (AM0101, v.1.0)
[21] See, for example: Schneider (2009)

ficult to verify. However, they generally require more resources for the programme administrators for the collection of data and subsequent determination of positive lists, benchmarks and market penetration thresholds than a project-by-project approach where the additionality assessment is undertaken by the project participants based on information from the specific project. Also, more standardized approaches may not necessarily reduce the number of free riders, since, in some sectors, they are not a good proxy for the feasibility of projects in absence of credits. As highlighted above, a low market penetration or low GHG intensity alone is not necessarily a good indicator whether a project requires additional incentives from a crediting mechanism to be implemented.

In our judgment, a combination of investment analysis and impact analysis, applied to project types rather than individual projects, is in most cases the most reliable and robust tool to assess, in a standardized way, the likelihood that projects are additional. This approach best correlates the additionality assessment to the underlying economic factors whether carbon credits make a difference in the decision to proceed with a project. The application to project types could result in positive and negative lists and thus objective criteria that are not prone to subjective assumptions or concerns over fraudulent information. In some sectors, market penetration approaches or performance approaches could complement or substitute the investment and impact analysis. We further recommend abandoning very subjective methodological approaches, such as the barrier analysis.

The considerable challenges when assessing additionality in a project based mechanism were also one of the reasons for stakeholders and Parties to propose new market mechanisms. In the following, we discuss whether and how the additionality assessment could be addressed in the context of sector based mechanisms and policy based mechanisms.

5.2. SECTOR BASED MECHANISMS

Sector based crediting mechanisms credit emission reductions in an entire sector (or sub-sector) (see section 2.3 above). This means that emissions from all installations that fall within the scope of the sector are covered under the scheme. Hence, the additionality of the emission reductions is also assessed for the sector as a whole and not for individual measures, technologies or projects. Multiple measures in different installations lead to overall emission reductions. As the overall emission reductions are considered, it is also not possible to use the project based approaches for additionality assessment which are linked to specific measures, technologies or projects. Rather, the additionality assessment is directly linked to the establishment of the crediting baseline. If the crediting baseline is set in a robust manner below the BAU emissions level, the emission reductions achieved are also deemed additional; a separate assessment of the additionality of the overall emission reductions is then not necessary. This greatly simplifies additionality considerations for sector based crediting mechanisms. The key challenge for ensuring additional emission reductions is the setting of a robust crediting baseline for the entire sector. Approaches for setting crediting baselines at a sectoral level are discussed in chapter 0 above.

In the context of the additionality of a sectoral crediting baseline, a controversial issue is how existing and future policies should be taken into account in establishing the crediting baseline. As highlighted in section 4.6 above, it seems reasonable to consider the impact of already adopted E- policies in the crediting baseline and to exclude E+ policies. A more difficult question is how planned and future E- policies should be taken into account. For transparency purposes, different scenarios could be developed for the future emissions path, including scenarios with already adopted policies and scenarios with planned policies, similar to the emission scenarios in national communications by Annex I Parties. Similarly, other factors, such as different fuel price developments could be reflected. The range of GHG projections can then give an indication of the likelihood of different BAU emission developments. The degree of conservativeness of the crediting baseline is then ultimately a policy choice.

Although the assessment of the additionality of GHG abatement measures at plant level is not needed for the integrity of the credits, it is an important consideration for an effective design of the incentive scheme of the sector based crediting mechanism. A sector based crediting mechanism will only be effective and achieve the envisaged emission reductions if the incentives for the plant operators in the sector are set in a way that rewards *additional* emission reductions and limits the number of free riders. For example, a subsidy scheme for all renewable power plants could accelerate the deployment of renewable energy but could also provide funding to many projects that are economically attractive without subsidies. For this reason, a careful evaluation of the design options for the scheme, including the additionality of different types of projects, is required. In assessing the additionality of individual measures for the design of the sectoral programme, the approaches from project based mechanisms could be employed.

An important advantage of a sector based crediting mechanism over a project based crediting mechanism is that the governments implementing the sector based crediting mechanism at host country level have an inherent incentive to design the scheme in a way to achieve additional emission reductions: if non-additional activities or projects are rewarded under the scheme, the emission reductions compared to the sectoral crediting baseline will be lower and the international credit inflow and revenues will be reduced.

However, establishing such an incentive scheme and ensuring that the incentives effectively provide additional emission reductions is one of the major challenges of sector based crediting mechanisms.

5.3. POLICY BASED MECHANISMS

Crediting mechanisms based on policies (see section 2.4 above) credit emission reductions achieved through the introduction, implementation and enforcement of policies. The emission reductions are additional if the policy is introduced and implemented due to the incentives from the crediting mechanism. If the policy would also be fully or partially implemented in the absence of the crediting mechanism, the emission reductions would not be additional.

Assessing whether or not the introduction and implementation of a policy is motivated by a crediting mechanism is probably an even more difficult undertaking than assessing the additionality of individual projects or setting a crediting baseline for sector based mechanism which ensures additional emissions reductions. As highlighted in section 4.6 above, policies that reduce GHG emissions are often motivated by several policy objectives, such as the diversion of the energy sources, enhancing energy security, enhancing public services, such as transportation or availability of electricity, realizing economic gains through the enhanced energy efficiency, saving natural resources, or reducing air pollution. Indeed, many developing countries are already adopting policies that reduce GHG emissions with or without international financial support. In many cases, reducing GHG emissions is probably one motivation among others for introducing such policies. This holds for most policies, with few exceptions. This is illustrated with the following examples:

- Many countries subsidize renewable power generation through feed-in tariffs, certificate schemes, investment subsidies, tax holidays or other financial incentives. The motivation for such schemes is often to diversify the economy and reduce dependency on fossil fuels, to foster innovation and technological change and to create jobs in a market of the future, to reduce air pollution from the use of fossil fuels, and to reduce GHG emissions. Many countries put such schemes into place even before international crediting through the CDM or other scheme were implemented and accessible. Even if the technologies are not yet economically attractive, it is thus difficult to assess whether or not such policies are introduced as a result of the incentives from a crediting mechanism.
- Many countries promote the use of energy efficient appliances, through labelling schemes, awareness programmes, efficiency standards, and other policies. For most efficient appliances, the savings in energy costs outweigh the higher costs for purchase of the equipment;

the use of energy efficient appliances generates welfare for the economy, even without considering the external costs of energy generation. The economic gains from energy efficient appliances are a key motivation for many countries to promote them. In addition, energy efficient appliances could reduce outages of the electricity network, dependency on fossil fuels and air pollution. In the light of these economic and social benefits, countries have significant incentives to introduce policies to promote the use of energy efficient appliances. As for the promotion of renewable energy it is difficult to assess whether or not such policies are introduced as a result of the incentives from a crediting mechanism.

› In contrast to the previous two examples, for some policies and regulations it is clear that the motivation is only or largely mitigating climate change. For example, N_2O emissions from adipic acid or nitric acid production or HFC-23 emissions from HCFC-22 are not major air pollutants and their destruction does not create economic benefits. In this regard, it is likely that any regulations to abate these emissions are motivated by climate change. In this case, a mechanism crediting the adoption, implementation and enforcement of such policies would likely generate additional emission reductions.

Another difficulty in assessing the additionality of a policy proposed for crediting is that the decision on policies often depends on specific political factors, such as the political power of different actors in the country, public awareness on the issue, etc. For most policies it would be difficult to assess whether and how the incentives from a crediting mechanism impact the political power balance in a decisive way.

A further challenge is that quantification of emission reductions. For some policies it could be difficult to establishing a clear causal relationship between the crediting mechanisms and the mitigation outcome. For example, subsidies and other economic incentives support the implementation of GHG reducing measures but may not always be decisive. Distinguishing projects implemented due to the subsidies from the free-riders may be methodologically challenging.

For these reasons, it seems difficult – if not impossible – to develop methodological approaches to assess the additionality of policies in a reliable manner. As the assessment of additionality is a key prerequisite for the integrity of any credits, we believe that a policy based crediting mechanism should not be further pursued. Exceptions could be policies that do not create significant economic, social or environmental benefits other than reducing GHG emissions and allow establishing a clear causal relationship between the crediting mechanisms and the mitigation outcome, such as regulation to reduce HFC-23 and N_2O emissions.

If Parties wish to pursue the crediting of policies, one possible way forward to derive criteria for the assessment of additionality could be a common practice analysis within a group of developing countries. For example, it could be assessed how many countries within the group of Least Developed Countries (LDCs) have introduced a policy to promote or regulate technology A. If none or only very few countries have yet introduced such a policy, it could be more likely that the introduction of such a policy is facilitated and thus accelerated through the incentives from a sectoral crediting mechanism. Another potential approach could be analysis the *societal* costs and savings from a policy (without external costs from GHG emissions). If a policy leads to societal costs, rather than savings, it could be argued that it is more likely that its introduction is mainly motivated by addressing GHG emissions. However, evaluating societal costs and savings is a difficult undertaking where assumptions in the analysis have significant impact on the results. Hence, it is not an objective way of assessing the additionality of a proposed policy.

6. GOVERNANCE ASPECTS

International oversight vs. decentralized approaches

For all three types of mechanisms a fundamental question is how governance of the mechanism should be designed to ensure integrity and efficiency of the mechanism. An important question is to what extent international oversight is needed or, on the other hand, how governance could be organized on domestic or bilateral level. There is a range of possibilities, from mainly international oversight, such as under the CDM, to international agreement on minimum common criteria and procedures, or full governance at domestic or bilateral level with requirements to report to UNFCCC. Under the Kyoto Protocol, key aspects to ensure the integrity of the mechanisms are under international oversight, including the issuance, transfer and accounting of units, and, in the case of the CDM, the rules governing the quantification of emission reductions and third party verification, whereas the assessment of whether projects contribute to achieving sustainable development is under the governance of the host Parties.

In climate negotiations, Parties disagree as to whether the NMM should be a centralized mechanism with a governance structure that would closely resemble the CDM or if it should allow for a more decentralised approach with (potential) common reporting and issuance procedures that would give host countries considerable flexibilities in developing their own approaches. Currently most of the countries of the Umbrella group and other proponents of a more lenient approach favour a decentralized approach, reducing central governance under UNFCCC in essence to the operation of a registry (INFRAS, 2013). On the other hand, the EU and others propose a centralized approach to governance, with a regulatory body, similar to the CDM Executive Board that centrally approves projects and issues units.

Table 11 provides a brief overview of the advantages and disadvantages of different governance approaches. A centralized approach has several advantages both from an environmental perspective and for market participants but is politically more challenging to agree upon. A decentralized approach poses considerable problems and risks for environmental integrity and market participants but may provide for a higher flexibility to account for specific circumstances in the host countries. In the case of a mixed approach, the impacts depend largely on the design of the approach, in particular to what extent common principles, rules and procedures are implemented at international level to ensure integrity and full fungibility of market units.

<table>
<tr><th>Governance approach</th><th>Advantages</th><th>Disadvantages</th></tr>
<tr><td>Centralized approach:
Rules and procedures are embedded in one international framework (UNFCCC) and oversight by one body (similar to the CDM EB)</td><td>› One single emission reduction unit with great fungibility
› Larger and more liquid market
› Consistent application or rules among Parties with comparable stringency / ambition of additionality criteria and crediting baselines
› Lower overall transaction costs
› Use of synergies with existing governance structures possible (e.g. CDM EB)
› High transparency
› Lower risks of double counting</td><td>› Politically challenging to agree on common rules and procedures
› Could be less flexible towards accommodating specific host country situations</td></tr>
<tr><td>Decentralized approach:
Rules and procedures are established by the mechanism operator (host country, bilateral, or non-governmental)</td><td>› Could provide more flexibility towards accommodating specific host country situations
› Could allow for more diversity in the available mechanisms
› Sovereignty of countries</td><td>› Smaller and less liquid market
› Quality of units from mechanisms may not be comparable
› More limited fungibility of units
› Higher overall transaction costs due to several parallel governance structures
› Less transparency for market participants
› Risks for "race-to-the-bottom" of standards due to competition for market share among the scheme operators
› Higher risks of double counting</td></tr>
<tr><td rowspan="2">Mixed approach:
Principles and general rules and procedures are defined by an international body (UNFCCC) but implementation and specific design is undertaken at domestic or bilateral level</td><td>› Could be politically a "middle" ground
› Could provide more flexibility towards accommodating specific host country situations
› Could allow for more diversity in the available mechanisms</td><td>› Potentially higher overall transaction costs
› Potentially less transparency for market participants due to multiple schemes</td></tr>
<tr><td colspan="2">Depending on the design:
› Comparable environmental integrity vs. "race-to-the-bottom" due to competing schemes at domestic level
› Full fungibility through issuance of one unit type vs. limited fungibility due to multiple unit types in fragmented markets
› Lower risk of double counting due to international accounting and market design rules vs. higher risk due to multiple mechanisms</td></tr>
</table>

Table 11 Types of governance for crediting mechanisms

Overlap with existing Kyoto mechanisms and synergies in governance

Another important governance aspect is whether and how mechanisms can co-exist without double counting of the same emission reductions. The relationship between the FVA and the NMM on the one hand and the existing three Kyoto mechanisms (CDM, JI and IET) on the other hand is still unclear. At least until 2020, all three Kyoto mechanisms will continue to exist. Accordingly, new mechanisms may overlap with existing Kyoto mechanisms in terms of emission sources, sectors and project types covered. For example, the NMM may cover a sector in a country in which CDM projects have already been implemented. If this is not carefully addressed, this could lead to double counting of emission reductions. Similarly, credited NAMAs which may be recognized under the FVA could overlap with CDM projects. Depending on the type of mechanism, options to avoid such double counting include amongst others: restricting new crediting mechanisms to projects not covered by CDM and JI, phasing out of crediting of CDM projects in the sector or policy covered by a new crediting mechanism or cancellation of CDM credits that fall within the scope of the new crediting mechanism.

Furthermore, it is still unclear whether and how the existing governance arrangements for the Kyoto mechanisms could be utilized for new mechanisms. For example, existing regulatory bodies could be expanded and adapted to also oversee new mechanisms. The CDM registry could also be used for new mechanisms. The international transaction log (ITL) could be expanded to oversee transactions of units used to attain pledges under the UNFCCC or for units issued under the NMM (Prag, Aasrud, Hood 2011). **Table 12** provides an overview of some of the issues arising from the co-existing of existing and new market mechanisms.

Options	Designs	Issues / comments
Transformation	› Extension/transformation of current mechanism to the NMM › Integration of current approaches into the NMM	› Baselines of new mechanisms would need to reflect projects from the existing mechanisms › Tools from existing mechanisms, such as grid emission factors or standardized baselines, could be used for the implementation of the NMM › Avoiding double counting
Phase out of current mechanisms	› Immediately › At end of current crediting period › At end of last crediting period	› Investor certainty › Avoiding double counting
Exclusive coexistence	› Sectors, project types, technologies between approaches are exclusive	› Investor certainty › Possibly limited application of NMM in countries with many projects from existing mechanisms

Table 12 Coexistence with other mechanisms

Stakeholder consultation

Another important governance aspect is transparency and stakeholder consultation. The possibilities for different stakeholders, including project developers, research institutions and non-governmental organizations has significantly contributed to the development of rules under the CDM. We recommend that in any crediting mechanisms, stakeholders have the opportunity to provide inputs, in a transparent manner, on key documents, such as standards and procedures, and projects, sectors or policies proposed for crediting.

7. CONCLUSIONS AND RECOMMENDATIONS

The international carbon market faces a difficult market environment, mostly due to the lack of ambition of mitigation pledges under the UNFCCC and the Kyoto Protocol and an oversupply of units from its flexible mechanisms. Nevertheless, policy makers and non-governmental standard setting organizations are in the process of reforming existing and establishing new carbon market mechanisms. Next to ETS, these include mostly project based crediting mechanisms, such as CDM, JI, VCS, CAR and GS, but also initiatives for sector based and policy based crediting mechanisms.

In considering the establishment of new crediting mechanisms or reforming existing mechanisms it is extremely important to draw on the lessons learned from existing mechanisms. In particular the experiences with the CDM provide important lessons and insights, due to its early implementation, the broad coverage of sectors and project types, the mature methodological framework, and the large number of projects. The approaches for baseline setting and additionality assessment are the most important methodological choices to ensure that emission reductions are real, additional, measurable and permanent and that the mechanism operates in a cost-efficient manner. This holds in particular for potentially up-scaled mechanisms that credit emission reductions for entire sectors or policies.

In **setting the level of the crediting baseline**, a common approach is to use the most likely BAU emissions level, i.e. the most reasonable and likely emissions development without the incentives from the crediting mechanism. However, a key lesson learned from existing mechanisms is that such baselines do not always result in a robust calculation of emission reductions. In some sectors, perverse incentives can undermine efforts to reduce emissions. In other cases, the estimation of future BAU emissions is associated with considerable uncertainty. For specific project types, the uncertainty band of the BAU emissions may be larger than the envisaged emission reductions, which can result in significant over- or under-crediting. This challenge is even more relevant for sector based or policy based crediting mechanism. For crediting baselines used for potentially large volumes of emission reductions, such as sector based or policy based crediting baselines, we therefore recommend the following approaches to address these issues:

› **Uncertainty assessment:** the uncertainty band of the most likely BAU emissions development should be determined, assessing the various sources of uncertainty and varying the underlying assumptions and parameters used to derive the BAU emissions level. The uncertainty band should be compared with the projected actual emissions and the baseline should be set in such a way that the emission reductions are real and additional at a high confidence level. This assessment will have different implications for different sectors, depending on the uncertainty of the emission reductions. In some sectors, this may imply that the crediting baseline can be set close to the most likely BAU emissions level, while in other sectors it may need to be set significantly below the most likely BAU emissions.

› **Assessment of potential perverse incentives:** potential perverse incentives, such as carbon leakage or market distortions, should be systematically evaluated for different stringency levels of the baseline. Where such incentives exist, the baseline should be set at a sufficiently conservative level to fully address them.

In some situations, these two assessments may reveal that perverse incentives and uncertainties with regard to BAU emissions cannot be appropriately addressed, for example, if the uncertainty band of the BAU emissions is larger than the envisaged emission reductions. We recommend not to further pursue crediting mechanisms in such situations and sectors but to use other ways to provide incentives for emissions reductions.

Once uncertainty and perverse incentives are addressed, the **ambition of crediting baselines** is largely a policy choice. Both too lenient and too stringent baselines can increase global mitigation costs. Too lenient baselines increase global GHG emissions, whereas too stringent baselines may decrease global GHG emissions. Overall, in balancing impacts on GHG emissions and mitigation costs, too lenient baselines have arguably more adverse impacts than too stringent baselines, especially if Parties wish to achieve net mitigation benefits from crediting mechanisms. We therefore recommend to set crediting baselines in ambitious, below BAU emission levels, while considering the specific circumstances of the sector and project type concerned.

The **update of crediting baselines** is a key methodological and policy choice which needs to balance two opposing objectives: providing for investor certainty and ensuring that crediting baselines continue to be robust over time. In practice, a reasonable approach is to update different underlying parameters at different time intervals, depending on how likely they may change over time. Dynamic crediting baselines should be the priority in most sectors, with clearly defined time intervals for updates of parameters (between 1 and 10 years) in order to provide investor certainty. Fixed crediting baselines, expressed in absolute tons of emissions, could be used in conjunction with absolute emissions pledges or domestic ETS. ETS caps and pledges are usually fixed ex-ante and a fixed crediting baseline could allow the crediting of emission reductions achieved beyond the ETS cap or pledge.

Whether and how **policies and regulations** should be considered in setting and updating crediting baselines is another challenge for crediting mechanisms, as two diverging policy objectives need to be reconciled: ensuring robust crediting baselines at or below BAU emissions and avoiding perverse incentives for policy makers not to adopt policies that lower GHG emissions or not to abandon existing policies which increase GHG emissions. In balancing these two policy objectives, we recommend to assess and compare the potential risks from either lenient crediting baselines or perverse incentives. In our judgment, the environmental risk from lenient baselines is in most cases more significant than the risk of creating perverse incentives for policy makers. We therefore recommend, as a general rule, that adopted policies and regulations reducing GHG emissions should be included in setting the baseline. In order to provide incentives to abandon policies that increase GHG emissions, such as fossil fuel subsidies, we recommend, as a general rule, that the effect of such policies is excluded in setting the crediting baseline. Both rules require exceptions though.

Robust methodological approaches used for **additionality assessment** are key for ensuring the integrity of crediting mechanisms. Considerable experience has been made with project based mechanisms, while less approaches have been proposed and tested for sector based and policy based crediting mechanisms.

For **project based mechanisms**, the main currently employed approaches, the barrier analysis and investment analysis, strongly depend on subjective assumptions and assessments, such as future fuel prices, and are prone to fraudulent statements, due to the information asymmetry between project developers and verifiers or regulators. Standardized approaches, such as positive and negative lists, emission performance benchmarks or market penetration approaches provide more objective means for additionality assessment but have other disadvantages. They usually require large data sets on sector characteristics in the country, including which type of technologies are used and their efficiencies. In addition, standardized indicators, such as the GHG emissions performance or market penetration, are not necessarily a good proxy for the likelihood that a project can go ahead without credit revenues. In some sectors, for example, projects with low GHG emissions or a small market penetration can nevertheless be economically highly attractive. In our judgment, a combination of investment analysis and impact analysis, applied to project types rather than individual projects, is in most cases the most reliable and robust tool to assess, in a standardized way, the likelihood that projects are additional. This approach best correlates the additionality assessment to the underlying economic factors whether carbon credits make a difference in the decision to proceed with a project. The application to project types could result in positive and negative lists and thus objective criteria that are not prone to subjective assumptions or concerns over fraudulent information. In some sectors, market penetration approaches or performance approaches could complement or substitute the investment and impact analysis. We further recommend to abandon very subjective methodological approaches, such as the barrier analysis.

For **sector based mechanisms**, an additionality assessment with project based approaches is not possible, as the overall emission reductions are credited against a sectoral crediting baseline. The emission reductions are assumed additional if they fall below the crediting baseline. However, the additionality of individual measures, technologies and projects within the sector is an important issue when designing the incentive scheme to reduce emissions in the sector. The sectoral programme is only effective if it largely rewards those projects that deliver additional emission reductions.

For **policy based mechanisms**, it seems difficult - if not impossible - to develop objective criteria to assess additionality. Policies are often motivated by several policy objectives, such the diversion of energy sources, enhancing energy security, enhancing public services, realizing economic gains through enhanced energy efficiency, saving natural resources, or reducing air pollution. Another difficulty is that the decision on policies often depends on specific political factors, such as the political power of different actors in the country and public awareness on the issue. This makes it difficult to assess whether and how the incentives from a crediting mechanism impact the political power balance in a decisive way. We therefore recommend not to pursue the crediting of policies. An exception could be policies that do not generate significant other benefits than reducing GHG emissions, such as, for example, regulations to abate N_2O emissions from nitric and adipic acid production, and allow establishing a clear causal relationship between the crediting mechanisms and the mitigation outcome.

The existing mechanisms also provide for important **overarching lessons learned** on baseline setting and additionality assessment. An important re-occurring issue is to what extent the methodological approaches should be generally applicable across project types, sectors and countries and to what extent they should reflect the specific circumstances of the project types, sectors and countries. In practice, important factors, such as the size, number, vintage, costs, performance and technical lifetime of the installations, the aggregation level and outputs and services provided, uncertainty, innovation rates, data availability, perverse incentives, competition, and other important parameters for baseline setting and additionality determination vary significantly between sectors and project types, and, in some cases, between countries. Hence, a variety of methodological approaches – rather than one unique approach – are required to set baselines and assess additionality in a robust manner and avoid significant over- or under-crediting. On the other hand, it is important to ensure comparability in the stringency of baselines. Based on the lessons learned from existing mechanisms, we recommend that crediting mechanisms should use specific methodological approaches that are best suited for the sector and project type concerned, rather than prescribing one or few methodological approaches for baseline setting and additionality assessment. The methodological approaches should not vary between countries with largely similar circumstances. Where possible, they should also be consistent across sectors and project types with similar circumstances.

Another general lesson learned is that methodological approaches should be developed based on actual data from installations, and be reviewed thoroughly and road-tested before their adoption and implementation. There is a need for more real world data from countries in order to objectively determine baseline emissions and current practice, mitigation cost and efficiencies. Furthermore, it is important to use objective and verifiable approaches and data.

Finally, a number of **governance aspects** arise from the introduction of new crediting mechanisms. A key aspect is to what extent the governance should be centralized and under UNFCCC supervision and to what extent it could be under domestic, bilateral and non-governmental governance structures. In our assessment, a more centralized approach has important advantages over a more decentralized approach, for ensuring environmental integrity, for private sector market participants, as well as for establishing a market with high liquidity. Without internationally agreed rules, the quality of units from different crediting mechanisms may not be comparable. A centralized oversight better ensures a similar stringency of crediting baselines across countries, sectors and project types, providing a level playing field for entities in the market and thereby enhancing the cost efficiency of crediting mechanisms. With centralized oversight, there is also a risk that competition between crediting mechanisms could lead to a "race-to-the-bottom", potentially leading to an oversupply of units with low quality and low market prices. In addition, to avoid double counting of emission reductions, common rules for accounting and the design of market mechanisms are required. For market participants, the overall transaction costs are lower and transparency is higher with a single market mechanism rather than in a fragmented carbon market. Fully fungible units also facilitate their use and can decrease global costs of mitigating climate change. Another important governance aspect is transparency and stakeholder consultation. Based on the experience with existing mechanisms, we recommend that in any crediting mechanisms, stakeholders have the opportunity to provide inputs, in a transparent manner, on key documents, such as standards and procedures, and projects, sectors or policies proposed for crediting.

Among the three type of crediting mechanisms, project based mechanisms are well established and their advantages and limitations are well known. They have demonstrated to be able to deliver units to the market at a significant scale. A key benefit of project based mechanisms is that they directly expose private entities to a carbon price and thereby provide incentives to reduce GHG emissions in a cost-effective manner. This is not necessarily the case for sector based and policy based mechanisms where private entities may receive other types of incentives. The biggest challenges for project based mechanisms are the subjective rules often used to demonstrate additionality and set crediting baselines. Standardized approaches increase the objectivity but do not necessarily reduce the number of non-additional projects qualifying for credit issuance. So far, a fundamental reform of additionality criteria has not yet been implemented in the existing project based mechanisms, although more rigorous tools, such as the impact analysis, are available. Sector based crediting mechanisms could provide significantly up-scaled emission reductions. Whether these reductions are additional depends on the quality and conservativeness of the crediting baseline. Deriving reliable crediting baselines could be challenging given that the future emissions of a sector depend on many factors that can change over time. A risk is that the uncertainty band of the likely BAU emissions in a sector could well exceed the envisaged emission reductions. In such cases, a robust crediting baseline would need to be set in such a conservative manner to ensure integrity that it would not provide any more incentives to pursue with such a mechanism. In this regard, careful analysis on a case by case basis is needed to assess whether sector based mechanisms have advantages over project based crediting mechanisms; they are not the silver bullet to the problems that project based mechanisms face.

REFERENCES

Bakker, van Asselt, Gupta, Haug, Saïdi 2009: Differentiation in the CDM: options and impacts. Report 500102 023, ECN-B--09-009, Netherlands, May 2009

CDM Policy Dialogue 2012: Climate Change, Carbon Markets and the CDM: A Call to Action. Report of the High-Level Panel on the CDM.

DNV 2004a: PDD for the project "Urban Transport Modernization Plan for Santiago, Chile (Transantiago)". DNV. Online available at: http://www.dnv.com/focus/climate_change/Upload/CDM_PDD_English1.pdf (24.04.2013)

DNV 2004b: PDD for the project "Mandatory Energy-Efficiency Standard for Room Air Conditioners in Ghana". DNV. Online available at: http://cdm.unfccc.int/filestorage/F/S/_/FS_837046608/Standards10-21fin.pdf?t=WHF8bWxyMzhvfDB5VsU4CK8oSgu6B0-5fTjy

EC 2012: Design Options for Sectoral Carbon Market Mechanisms. European Commission/DG Climate Action. Document CLIMA.B.3/SER/2011/0029. Brussels.

EPA 2008: LFG Energy Project Development Handbook: Landfill Gas Modeling. Environmental Protection Agency, Washington. Online available at: www.epa.gov/lmop/documents/pdfs/pdh_chapter2.pdf (26.09.2013)

IMF 2011: Market-Based Instruments for International Aviation and Shipping as a Source of Climate Finance. Background Paper for the Report to the G20 on ―Mobilizing Sources of Climate Finance‖. IMF, Washington.

INFRAS 2013: New Climate Mitigation Market Mechanisms: Stocktaking After Doha. Report for the Dutch Ministry of Infrastructure and the Environment (I&M) and the Swiss Federal Office of the Environment (FOEN). http://www.bafu.admin.ch/emissionshandel/05556/12438/index.html?lang=en

Lazarus, Erickson, Schneider: Potential for International Offsets to Provide a Net Decrease of GHG Emissions, SEI Working Paper 2013-06, Stockholm Environment Institute – U.S. Centre, Seattle, USA, September 2013

Prag, Aasrud, Hood, 2011: Keeping track: Options to Develop International Greenhouse Gas Unit Accounting After 2012. OECD unclassified paper COM/ENV/EPOC/IEA/SLT(2011)1.

Prag, Briner 2012: Crossing the Threshold: Ambitous Baseslines for the UNFCCC New Market-Based Mechanism. Document name: COM/ENV/EPOC/IEA/SLT(2012)2. OECD/IEA, Paris.

Schneider 2009: Assessing the additionality of CDM projects: practical experiences and lessons learned. Climate Policy, 9 (2009), 242–254

Schneider 2011: Perverse incentives under the Clean Development Mechanism (CDM): an evaluation of HFC-23 destruction projects. Climate Policy, 11 (2011), 851–864

Spalding-Fecher 2013: National policies and the CDM rules: options for the future, Swedish Energy Agency, September 2013

UNFCCC 2012: Ad Hoc Working Group on Long-term Cooperative Action under the Convention Fifteenth session, part two Doha, 27 November 2012. Document: FCCC/AWGLCA/2012/MISC.6/Add.6

Vrolijk, Phillips 2013: Net Mitigation through the CDM. Swedish Energy Agency, September 2013