Hamburgisches
WeltWirtschafts
Institut

Voluntary compensation of GHG emissions: Selection criteria and implications for the international climate policy system

Sonja Butzengeiger

HWWI Research
Report No. 1
by the
HWWI Research Programme
International Climate Policy

Hamburg Institute of International Economics (HWWI) | 2005
ISSN 1861-5058

Sonja Butzengeiger | Research Fellow
Hamburg Institute of International Economics (HWWI)
Neuer Jungfernstieg 21 | 20354 Hamburg | Germany
Tel +49 (0)40 34 05 76 - 62 | Fax +49 (0)40 34 05 76 - 76
butzengeiger@hwwi.org | www.hwwi.org

HWWI Research
Hamburg Institute of International Economics (HWWI)
Neuer Jungfernstieg 21 | 20354 Hamburg | Germany
Tel +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 76
info@hwwi.org | www.hwwi.org
ISSN 1861-5058

HWWI Research Report No. 1
by the HWWI Research Programme
International Climate Policy

Voluntary compensation of GHG emissions: Selection criteria and implications for the international climate policy system

Sonja Butzengeiger

Hamburg Institute of International Economics (HWWI) | 2005

List of Contents

List of Figures

List of Tables

List of Abbreviations

AAU(s)	Assigned Amount Unit(s)
CAN	Climate Action Network
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CDM EB	Executive Board
CER(s)	Certified Emission Reduction(s)
CHP	Combined Heat and Power Generation
CO_2	Carbon Dioxide
$CO_{2\text{-eq}}$	Carbon Dioxide Equivalents
COD	Chemical Oxygen Demand
COP	Conference of the Parties
CE	Compensating Entity
DNA	Designated National Authority
EEA	European Energy Agency
EIA	Environmental Impact Assessment
ERU(s)	Emission Reduction Unit(s)
EU	European Union
EU ETS	European Union Greenhouse Gas Emission Trading Scheme
FCE	Fictitious Compensating Entity
GDP	Gross Domestic Product
GHG(s)	Greenhouse Gas(es)
GIS	Green Investment Scheme
GS	Gold Standard
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
GWP	Global Warming Potential
HC	Host Country
HEW	Hamburgische Electricitäts-Werke AG
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
JI	Joint Implementation
k	Kilo
kWh	Kilowatt hour
LULUCF	Land Use, Land Use Change and Forestry
Mt	Million tonnes (10^6)
MW	Megawatt
MWh	Megawatt hour
NAP	National Allocation Plan
NCP	National Compensation Project
NGO	Non-Governmental Organisation
ODA	Official Development Assistance
OE	Designated Operational Entity
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
p.	page
PDD	Project Design Document
PIN	Project Idea Note
PPA	Power Purchase Agreement
PV	Photovoltaics
RFI	Radiative Forcing Index
SAR	Second Assessment Report of the IPCC
SD	Sustainable Development
S_n	Indicator score
th	thermal
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VC	Voluntary Compensation
VCP	Voluntary Compensation Project
VER(s)	Verified Emission Reduction(s)
WBGU	Wissenschaftlicher Beirat der Bundesregierung Gobale Umweltänderungen
WE	Weighted Evaluation
WMO	World Meteorological Organization
w_n	Weighting Score
WWF	World Wildlife Fund

Executive Summary

Legal entities or persons might want to neutralize the greenhouse gas emissions they have caused with their activities. In the context of this paper, voluntary compensation is defined as the cancellation of emission reduction credits that have been generated in a project-based approach. The question "Which compensation project should be selected?", which is one of the central aspects of analysis, is a classic example of decision theory from the perspective of the compensating entity.

Two major drivers for voluntary compensation are identified: moral responsibility and economic benefits. The first category covers environmental and social issues, the second marketing and image effects for the compensating entity.

In section 2, major characteristics of compensation projects are identified. These include inter alia the delivery of real emission reductions, environmental impacts, support of sustainable development, costs of compensation, credibility and public reputation, project type, and situation in the host country. In addition, the concept of "high-quality projects" is discussed. Potential interactions between those characteristics are examined, looking at project type and price of reduction certificates. Thereafter, a methodological approach for the selection of voluntary compensation projects is proposed. The methodology considers both the value system of the compensating entity and project characteristics. It is based on a differentiation between selection criteria and indicators, which operationalize the criteria. Selection criteria, for example a project's success probability under a given regulatory regime, or project type and location, are weighted according to the preferences of compensating entities. Several indicators are of a quantitative nature, others are derived from qualitative assessment. A project's performance with regard to the individual indicators/criteria is to be evaluated by experts and results in a quantitative scoring. Thus, a ranking of different projects within a given group is possible.

Section 3 applies the developed methodology to several case studies. The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH decided to offset its CO_2 emissions by means of reduction certificates from a Clean Development Mechanism (CDM) project. Five of the submitted project ideas have been selected for this study. Following that, a sensitivity analysis for the defined parameters – indicator scores S_n and weighting factors w_n – is conducted. Major results are that the proposed methodology is indeed suitable to consider both project characteristics and individual value systems of compensating entities in a standardised manner. An adaptation to the individual task may be appropriate, e.g. the consideration of additional/less indicators. Expert judgement is necessary to comprehensively consider all project characteristics, especially the facets of CDM regulations. The case studies also reveal that, regardless of the predefined structures of the approach, a considerable degree of freedom is given to the evaluating expert. In order to enhance consistency of results, the evaluation of a given set of projects should be conducted by the same expert. Finally, quantitative results should not be interpreted too strictly. The methodology allows a grouping of projects, but not a sharp ranking based on the second decimal point.

In section 4, the interactions of voluntary compensation and international climate policy systems – the Kyoto System and the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) – are discussed, both in qualitative and quantitative terms. Preconditions for interactions are that the compensating entity chooses an underlying regulative regime which generates credits that are also eligible under the above named regimes. The most relevant category currently is the CDM, followed by Joint Implementation (JI) projects. The analysis comes to the conclusion that theoretically interactions exist. Voluntary compensation increases the demand for the given certificate type and thus increases market prices. At the same time, the necessity for further emission reduction increases, which enforces the ecological objective of the climate policy systems. However, quantitative impacts of voluntary compensation will be very limited in the short to medium term. This evaluation is based on a survey of service providers on expected volumes and certificate types.

1 | Background and objectives

1.1 | Scientific background: anthropogenic contribution to global warming

A potential interrelation between anthropogenic emissions of greenhouse gases (GHG) and increases in global temperatures has been recognised by the international community in the 1980s. Since then, intensive research has been conducted by natural scientists to evaluate the thesis of human interference with the global climate system. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was founded by the World Meteorological Organization (WMO) and the UN Environment Programme (UNEP). The IPCC is a panel of international experts that assesses the state of international climate change science. Its findings are reported in regular intervals and represent the consensus of experts involved from all over the world.

It is obvious that these analyses contain uncertainties, e.g. uncertainties within models and model assumptions as well as uncertainties regarding the impact of complex parameters such as impacts of clouds and dust particles. Furthermore, uncertainties are due to the natural variability of the climate system itself (Hadley Centre, 2004). However, climate models have been improved over time and new scientific findings have been included, e.g. with regard to the influence of certain parameters. In 1995, the Max Planck Institute for Meteorology, Hamburg, concluded that the natural greenhouse gas effect is reinforced by anthropogenic behaviour with a 95% probability (WGBU, 1995).

In its Second Assessment Report (SAR) from 1996, the IPCC concluded that the "balance of evidence suggests that there is a discernible human influence on global climate" (IPCC, 1996a, p. 22). In the Third Assessment Report (SAR, 2001), the IPCC stated that "the major part of warming which has appeared in the past 50 years results from the increase of greenhouse gas concentrations in the atmosphere". The IPCC also expected an average temperature increase of 1.4 to 5.8 °C by the year 2100 compared to 1990 (IPCC, 2001a, p. 13) with a medium value of 2.5 °C. Estimates of the Second Assessment Report were only 1.0 to 3.5 °C over the same period of time (IPCC, 1996). The Hadley Centre, UK, recently estimated the most likely warming for a doubling of atmospheric CO_2 to be 3.5 °C, with a 90% probability that the warming will be between 2.4 °C and 5.4 °C (Hadley, 2004).

One central question with regard to climate change is its consequences for social, economical and ecological systems. A common understanding is that impacts will strongly differ by region. Impacts will range from increases in both maximum and minimum temperatures, changes in regional precipitation patterns, increases in tropical cyclone peak wind intensities, melting of arctic ice and inland glaciers and, in the long term, increases of the sea level. A detailed analysis can be found in IPCC (2001). A quantification of economic effects currently is not possible on a global scale. However, the German Advisory Council on Global Change (WBGU) argued as early as 1995 that at least a reduction of 45-50% of industrialised countries' CO_2 emissions[1] is necessary in order to stay in a "tolerable temperature window" concerning the social and economical burden of climate change impacts: a 5% reduction of the global gross domestic product (GDP) was considered as non-acceptable (WBGU, 1995).

1 The underlying assumption is that emissions of Non-Annex-I-countries do not further increase. Non-CO_2-Gases had not been included in this evaluation.

Today, the WGBU argues for a CO_2 concentration target of 450 ppm, which requires a reduction of 45-60% of global energy related Carbon Dioxide plus significant reductions of Non-CO_2-Gases. Industrialised countries should reduce their emissions by 20% by 2020 (WBGU, 2003), and by 77% in 2050 (WBGU, 1997) – always in comparison to 1990 levels.

1.2 | Political and economic background

In 1992, the international community agreed that climate change constitutes a serious threat and that measures must be taken to stabilise GHG concentrations in the atmosphere at a level that prevents "dangerous anthropogenic interference with the climate system" (Art. 2 of the UN Framework Convention on Climate Change (UNFCCC)). The UNFCCC entered into force in 1994 and laid the basis for the Kyoto Protocol (1997). The latter came into effect on February 16th, 2005 and defines emission targets for 38 industrialised countries, the so called Annex-B countries. Targets are defined for the commitment period 2008-2012, compared to 1990 emissions, for a basket of six (groups of) greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6) as well as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

Besides target setting, core elements of the Kyoto Protocol are the so called flexible mechanisms – namely International Emissions Trading (IET), Clean Development Mechanism (CDM) and Joint Implementation (JI). These market-based instruments have been included to increase the economic efficiency of the Kyoto Protocol, i.e. to reduce costs of attaining the given environmental target. The background to all these mechanisms is that, contrary to local pollutants, the location of GHG emission is irrelevant for its global warming effect. Consequently, it is economically rational to direct reduction measures to those places where mitigation costs are lowest. Comprehensive discussions on the Kyoto Protocol and efficiency gains by IET are given in Oberthür/Ott (1999) and Tietenberg (1985).

While IET is the trading of emission rights primarily on the level of Annex-B countries, CDM and JI are project based mechanisms and create reduction certificates, which then can be accounted on the emission target of a given country. One central aspect of the project based mechanisms is the

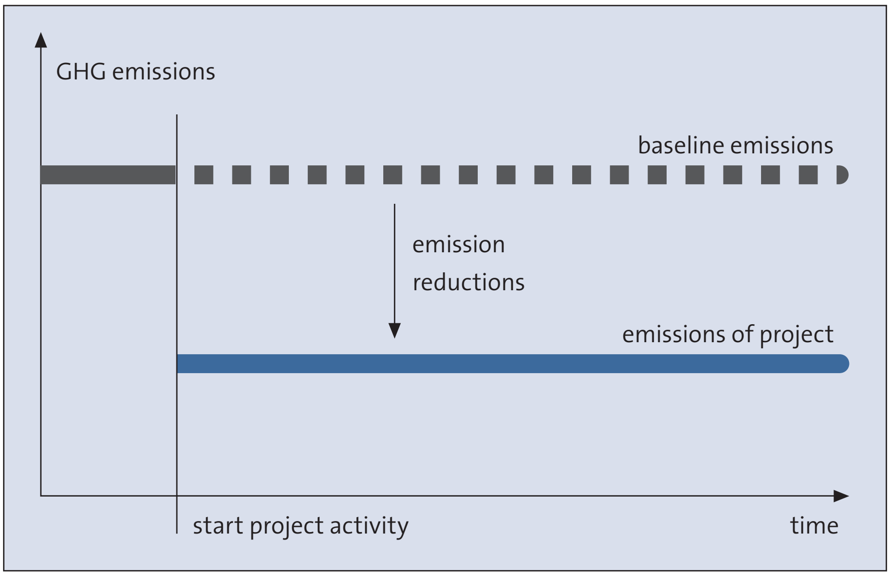


Figure 1: Quantification of emission reductions – concept of baselines

quantification of emission reductions due to the project activity. For CDM projects and JI projects (Second Track), this is done by means of a "baseline". The baseline constitutes a reference scenario for the emissions situation that would have existed in the case that the project activity was not conducted. Accountable emission reductions can be quantified in subtracting the projects' (real) emissions from the (theoretical) emissions baseline of the baseline scenario, also see Figure 1, p. 10. More detailed information on determinants for baselines and typical CDM/JI project cycles can be found in chapters 2.2 and 3.3.

Generated reduction certificates have a monetary value and can be traded like emissions rights.

1.3 | Background of voluntary compensation

The concept of emission certificates as described above can not only be applied by Parties of the Kyoto Protocol, but also by other stakeholders to compensate for their GHG emissions or – in some cases – to comply with national climate policy targets[2]. Such stakeholders can be legal entities like companies and public institutions or individuals. In the following, all such stakeholders will be subsumed under the generic term compensating entity (CE). Compensation means that GHG emissions that have been caused by a certain activity or behaviour are "neutralized" by equivalent emission reductions elsewhere.

The following example visualizes the concept of voluntary compensation (VC): In a given year, travelling activities of a company have caused emissions of 20,000 t CO_2. These emissions will be offset by reducing an equivalent amount GHG emissions (20,000 t $CO_{2\text{-eq}}$) elsewhere. The reduction project could, for example, be the avoidance of methane emissions[3] from a landfill or the increase in efficiency of a combustion installation. The travelling activity thus becomes "climate neutral".

The concept of emission certificates allows players to compensate for their emissions relatively easily, whereas physical mitigation of emissions is not realisable for many. Commercial service providers started to offer voluntary compensation services in the early 2000s.

Today, several compensation products are on the market and usually include the following steps:

– calculation of emissions to be compensated by a given activity,
– information on the compensation project(s) or even selection choice for the customer,
– payment and certification of compensation.

Offered products/services differ with regard to the calculation method, types of mitigation projects used as well as project standards involved, project location and certification mode. Sterk and Bunse (2004) give an overview of commercial products on the market and highlight some of their differences.

Besides using commercial services, a compensating entity has the option to either buy reduction certificates on the carbon market (e.g. via a broker), to buy options of reduction credits from a selected project or to invest in a mitigation project himself. One common aspect of these options is that the compensating entity has to select a mitigation project that fits his demands. Determinants for this selection process are the central aspect of this paper, also see chapter 1.4.

2 The acceptance of Certified Emission Reduction Credits (CERs) from CDM projects under the European Union Greenhouse Gas Emission Trading Scheme is an example hereof.

3 Methane is one of the GHGs covered by the Kyoto Protocol and has a global warming potential (GWP) of 21 – compared to CO_2.

Box 1: GHG emissions suitable for voluntary compensation

Which GHG emissions are suitable for compensation?
Basically, all types of GHG emissions can be compensated for. A first differentiation is possible between *direct* and *indirect* GHG emissions. Direct emissions are those which are released directly and immediately into the atmosphere. Indirect emissions are those which occur in a different place and at a different time from the activity itself.
Major sub-categories of direct GHG emissions are emissions related to transport (car, train, airplane, maritime transport) and to space heating (households). If electricity is generated for own consumption e.g. by means of a diesel generator, resulting emissions would be counted as direct emissions as well. Indirect emissions can be differentiated into production-related emissions, application-related emissions (including e.g. centralized electricity generation) and disposal-related emissions. Basically, emissions of the whole product cycle can be included.

While voluntary compensation of GHG emissions is still a young and small market, there are already some remarkable examples: the conferences Renewables 2004 (Bonn) and Carbon Market Insights 2004 and 2005 (Amsterdam) were designed CO_2-"free". The German Delegation chose to offset travelling emissions to the 10th Conference of the Parties (COP) of the UNFCCC in Buenos Aires 2004, and the annual international conference for hydrogen and fuel cells technologies in Hamburg is also CO_2 neutral since 2002. A further example of CO_2 neutral events will be the Soccer World Cup 2006 (Green Goal, 2005).

1.4 | Objectives of the paper

The underlying study has three objectives. The first objective is to discuss which criteria are suitable for the selection of compensation projects while considering the value system of the compensating entity – a classical case of applied normative decision theory. This is done in section 2 of the paper. One central aspect will be the environmental integrity of approaches used for voluntary compensation of greenhouse gas emissions. Costs per t CO_2 equivalent as well as project risks are two other main categories. As a first step, drivers for voluntary compensation are identified as they constitute the basis for project selection. In addition, a review of existing selection concepts on the international level is given. Following this, relevant project parameters and interactions between those parameters will be discussed. Based on the insights from those analyses, a methodology for project selection will be developed and presented as a proposal.

The second objective is to conduct case studies to test the theoretical concept and to gain an understanding of its practical consequences (section 3). A case in point is the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, which decided to offset its CO_2 emissions in 2003. Several project ideas had been submitted to the GTZ to apply for the compensation project. The paper will exemplarily evaluate some of them under the value system of the GTZ and under a fictitious second value system as sensitivity analysis. These case studies include:

– a hydro power project in India,
– a wind energy project in North Africa,

– a landfill gas project in North Africa,
– a biological waste water treatment plant in South East Asia,
– an industrial fuel-switch project in South America.

Finally, in section 4 the interactions of voluntary compensation projects and the international climate policy system will be discussed. The focus is on the Kyoto System and the European Union Greenhouse Gas Emission Trading Scheme (EU ETS). Underlying methodologies of this section are a qualitative theoretical analysis and a quantitative evaluation based on a survey of service providers.

It should be noted that the paper does not discuss or evaluate options for quantification of emissions that are to be compensated for. Neither does it go into detail on quantification options for emission reduction certificates as these issues have already been discussed in detail previously by other researchers, for instance, baseline development, by Müller-Pelzer (2004). The concept of “additionality” is discussed by Langrock et al. (2000) and Greiner/Michaelowa (2003). The current status of CDM regulations is described by Michaelowa (2005).

2 | Selection of voluntary compensation projects

The selection of GHG reduction projects for voluntary compensation may be considered a typical case of decision theory. The paper deals with aspects of normative decision theory; descriptive aspects are not analysed. Per definition, normative decision theory "is a theory about how decisions should be made in order to be rational" (Hansson 1994, p. 6). One can differentiate between several stages of a decision process. For example, Brim et al. (1962, p. 9) define the following phases:

1. Identification of the problem
2. Obtaining necessary information
3. Production of possible solutions
4. Evaluation of alternatives
5. Selection of a strategy for performance
6. Implementation of the decision

For the purpose of the paper, the problem is defined as the selection of an appropriate GHG compensation project that satisfies the demands of the compensating entity while delivering environmental benefits in an optimal way. In the following chapters, necessary information both on compensating entities' demands and environmental aspects are obtained, different possible solutions are drawn up and a selection strategy is developed. An evaluation of the alternatives is conducted by means of the case studies in chapter 3. It becomes obvious that there is some overlapping of the phases defined by Brim et al.

The paper does not elaborate on the theoretical concepts of decision-making under certainty, under uncertainty, or under ignorance. Hansson (1994), Laux (2005), and Schmidtke (2004) provide detailed information on this aspect. However, elements of the underlying concepts are applied within this study.

2.1 | Drivers for voluntary compensation

What is the motivation for voluntary compensation of GHG emissions? Answers to this question are fundamental for the discussion of selection criteria as the overarching targets of a compensation entity influence its demands on a compensation project. Two main groups of drivers can be identified:

– moral responsibility, and
– economic benefits.

These driver groups can be further distinguished. Table 1 gives an overview of driver groups, individual groups and elements of such drivers.

Most of these drivers and elements are self-explaining, so only a few aspects are highlighted in the following. At first glance, one might question how compensation of GHG emissions might contribute to sustainable development. The underlying idea is that some mitigation projects can contribute to the sustainable development of the host country, if they entail the transfer of new/more efficient technologies and technological know-how. As the host

Group	Driver	Element
Moral responsibility	Environmental responsibility	Reduction/avoidance of harmful impacts on the global climate system by own behaviour
		Other positive environmental effects, e.g. soil protection, biodiversity, reduction of local air pollutants
	Social responsibility	Global fairness – e.g. work towards equal/similar per capita emissions
		Responsibility for future generations
		Contribution to sustainability of lifestyles and economy
Economic benefits	Image/ Reputational effects	Compensation offor activities leading to a negative public reputation
		General improvement of public image
	Marketing effects	Marketing of a given event or a given product
		Marketing of a given brand name or legal entity

Table 1: Drivers for voluntary compensation

country can transfer this knowledge and technologies to other sectors, it will be enabled to switch to a sustainable development path more quickly. The contribution to host country sustainable development is one central aspect of the CDM, also see chapter 2.2. On the investor country's side, one might argue that compensation projects increase the overall awareness of climate change and thus foster a more responsible behaviour.

The compensation of GHG emissions can also have positive marketing and/or image effects[4]. It underpins an entity's responsible behaviour and the entity will be evaluated as doing "something good". The German brewery Krombacher can be cited as an example here. In 2002/2003, it ran a large marketing campaign by promising that for each beer crate sold, it would buy and thus save one square meter of tropical rain forest (Krombacher, 2003). This is comparable with compensation for GHG emissions as it targets a well-known, global problem. Further examples of event marketing are provided in chapter 1.3.

4 There is some overlapping between the drivers' marketing and image/reputational effects.

Differentiation of drivers by groups of compensating entities?

One might pose the theory that *private players* are exclusively driven by the first category, while for *legal entities* economical drivers dominate. In practice, however, the above identified drivers act together and result in a compensation decision. The share of moral and economic drivers will depend on the visions and objectives of the legal entity. Commercially driven companies can – in principal – be expected to put more emphasis on marketing and image effects.

2.2 | Existing categories of reduction certificates and underlying regulative regimes

Before discussing the relevance of individual selection criteria, an overview of formal categories of reduction certificates is given. On the international level, various regulative regimes exist. They differ with regard to eligibility requirements, formalities, and rules for quantification of emission reductions. The main categories are:

– CDM Projects, which generate Certified Emission Reductions (CERs);

– Joint Implementation (JI) or National Compensation Projects (NCPs), which generate Emission Reduction Units (ERUs);
– Verified Reduction Projects, which generate Verified Emission Reductions (VERs); and
– Green Investment Schemes (GIS), which result in project-backed Assigned Amount Units (AAUs).

A further option to compensate GHG emissions would be to retire emission allowances, e.g. from the EU emissions trading scheme or AAUs, without having used the right to emit. As this category is not connected to mitigation projects, it is not further considered in the following. Neither are non-verified emission reductions considered, because they do not adhere to any rules at all.

Some of the above named categories can further be divided into sub-categories. For example, the category CDM entails the sub-categories "Regular Scale", "Small Scale" and "Gold Standard". A further differentiation is possible between technical projects and "LULUCF projects" (which is not eligible under the Gold Standard category). An overview of existing project categories is provided in Figure 2. Major characteristics of the relevant categories are presented below.

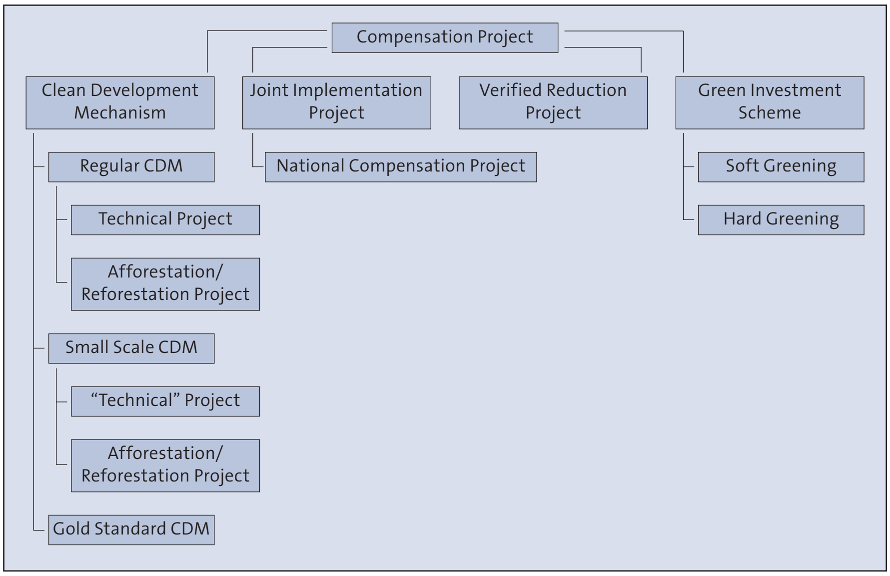


Figure 2: Overview of common project categories

Clean Development Mechanism Projects

The CDM is one of the project-based mechanisms under the Kyoto Protocol (Article 12) and officially started in 2000. A GHG mitigation project is undertaken in a so-called "Non-Annex-I-Country", which is a developing country. GHG-reductions are quantified by means of the above described baseline concept and result in Certified Emission Reductions. At the same time, the CDM is supposed to support developing countries with their sustainable development.

In recent years, a quite complex set of regulation has been developed on the international level. The most important statutes are the Marrakech Accords as well as decisions of the so-called CDM Executive Board (CDM EB). Major elements of the accreditation process for CDM projects are:
– host country approval and adherence to national sustainability criteria, if defined by the host country;
– establishment of a Project Design Document (PDD) as the basis for registration at the CDM EB. The PDD entails a detailed project description, the

baseline choice and application – including an additionality check – and the quantification of expected CERs, the Monitoring and Verification Plan, as well as information on public participation;
- validation of documents by an independent authority (Designated Operational Entity, OE);
- registration of the project by the CDM EB;
- project implementation and monitoring/documentation of the project activity by the project developer;
- verification and certification by the OE;
- issuance of CERs by the CDM EB. 2% of the CERs are withheld by the CDM EB. Revenues from their sale will be spent on adaptation measures in developing countries.

Given the fact that developing countries do not have binding emissions targets under the Kyoto Protocol, the concept of additionality is of special relevance. It has been debated intensively as interests of project developers and environmental advocates often clash.

Several sub-categories of the CDM exist. A first differentiation is made with regard to "project size" – in terms of installed capacities and/or annual emission reductions. Small scale projects benefit from simplified rules and documentation requirements, whereas regular scale projects have to pass a strict and more complex project cycle. Second, technical projects can be distinguished from afforestation and deforestation projects (so-called "sinks projects"). Due to their special characteristics, separate rules have been defined for the latter.

More detailed information on CDM project cycles and determinants for baselines can be found in Krey (2004), Michaelowa (2001), Butzengeiger et al. (2005), Michaelowa et al. (2003a), Bode et al. (2002), CaPP (2002). Some aspects will be highlighted in chapter 3.3.

Gold Standard CDM Projects

Finally, the concept of Gold Standard (GS) has to be mentioned. It has been developed by environmental NGOs, which are concerned about the environmental integrity and the general quality of CDM projects. The Gold Standard defines quality standards for CDM (and JI) to ensure that projects deliver climate protection and sustainable development objectives. These standards are grouped into project type, additionality and baselines and sustainable development criteria. Certain project types like sinks projects, large hydro power projects or fossil fuel related projects are excluded. A project's additionality is checked by a set of questions, all of which are aiming to answer the two basic questions "Would the project have occurred in the absence of the CDM?" and "Will the project result in lower greenhouse gas emissions than would have occurred in the absence of the project?".

The sustainability screening consists of an environmental impact assessment (EIA), the application of a sustainable development indicator basis and a review of the public consultation process. A separate PDD for Gold Standard Projects has been developed that reflects the additional requirements.

In short, the Gold Standard stands for a quality label in terms of environmental benefits and contribution to sustainable development. More information on the Gold Standard is provided by WWF (2002, 2003) and Sterk/Langrock (2003).

With regard to voluntary compensation, the most relevant characteristics of CDM projects are that the location of the project is restricted to developing countries, that the detailed set of rules guarantees a minimum "quality level" and that there are several sub-categories. The Gold Standard Label can be considered as the premium-quality sub-category.

Joint Implementation and National Compensation Projects

These project-based mechanisms function similarly as CDM projects. The major difference is that they take place in "Annex-I-Countries", i.e. industrialised countries. According to the regulations of the Kyoto Protocol, this implies that emission reduction credits generated by a project activity are deducted from the host country's emissions budget. The host country thus has an interest not to overestimate the amount of emission reduction credits by a given project activity.

Joint Implementation is defined in Article 6 of the Kyoto Protocol, and will commence in year 2008. Formalities for JI projects depend on the on the host country. The easy first track can be used, if the host country fulfils all eligibility criteria under the Kyoto Protocol. In this case, the host country can define its own criteria for baselines and issuance of ERUs. If the host country does not fulfil all eligibility criteria, a similar project cycle as for CDM projects results. This also includes the approval by a Supervisory Committee (equivalent to CDM EB) and an external verification by Independent Authorities (equivalent to OE). For details see Michaelowa (2001).

National compensation projects are unilateral JI projects. The idea of NCPs evolved during the discussions on the EU Greenhouse Gas Emission Trading Scheme (EU ETS) in late 2003 (AGE 2004). Since the EU Commission has a sceptical attitude on NCPs due to potential overlapping/double-counting with EU ETS, NCPs are only in the conception-phase. Rules still have to be defined. In sum, these projects are not yet of practical relevance, but this can be expected to change in the next 1 to 2 years.

Verified Reduction Projects

The major characteristic of Verified Reduction Projects is that there are no general, internationally defined rules. Project developers apply their own standard, which implies that project characteristics and quality can vary significantly. A minimum quality is suggested as reductions are verified. However, no verification standards exist. The certificate unit of this project type is called Verified Emission Reductions (VERs). VERs cannot be used for compliance under the Kyoto Regime or under the EU ETS.

In short, there are no restrictions in time, place or project type. As no minimum quality standards are defined, a compensating entity that is concerned about the quality aspect will need to evaluate a given project in detail. An interesting aspect with regard to transaction costs is that one could apply CDM standards without going through the formal CDM process. This would reduce transaction costs while setting quality requirements.

Green Investment Scheme (GIS)

The basic idea of GIS is that Assigned Amount Units (AAUs) of an Annex-B-Country of the Kyoto Protocol are sold and the revenues are re-invested in GHG reduction measures. One differentiates between soft and hard GIS. Soft GIS is the promise of the host country to conduct political measures as climate change or energy conservation awareness-campaigns, etc. Hard GIS entails a direct investment in technical mitigation measures. The latter category thus generates "project-backed AAUs".

With regard to marketing/image effects of voluntary compensation, the use of GIS must be evaluated carefully. The reason is due to the political background of GIS. It is based on the fact that many countries in transition own significant amounts of "surplus AAUs" as a result of strongly declining GHG emissions since 1990 due to economical decline. Although this does not have negative environmental impacts, the whereabouts of hot air is a politically sensible issue (key word "indulgence trading"). For details of GIS see Kokorin (2003), Point Carbon (2005a).

Having presented the major characteristics of different project types, cost implications will be compared briefly. Due to the different characteristics and options for utilisation, the individual certificate categories are traded as separate commodities. Table 2 gives an overview of typical price ranges for "Candidate CERs/ERUs", CERs/ERUs, AAUs and VERs. It becomes obvious that the expense for compensation also depends on the compensating entities´ choice of certificate type, as prices vary by an order of magnitude.

Commodity Type	Vintage Year	[€/t $CO_{2\text{-eq}}$]
Candiate CERs/ERUs	2000/08-2012	1.0 - 3.5
CERs/ERUs	2000/08-2012	4.0 - 7.0
AAUs	2008-2012	4.0 - 6.0*
EU allowances	2005-07	7.5 - 17.5
VERs		0.5 - 1.5

*price prior to the enforcement of the Kyoto Protocol

Table 2: Price ranges for different certificate types
Source: Von Ruffer (2004), various GHG market newsletters

2.3 | Relevant project characteristics

2.3.1 | Literature review

Selection criteria for voluntary compensation projects (VCPs) have not been comprehensively identified or evaluated in current literature. Usually, a few criteria are selected and then discussed qualitatively. Findings of relevant papers are summarised below.

Besides the price of reduction certificates (€ or $ per ton of $CO_{2\text{-eq}}$), Braun and Stute (2004) evaluate service providers of VC on the basis of whether an independent certification of emission reductions is conducted as a quality check and if compensation projects have already started. If projects are still to be developed, this can be interpreted as an indicator for a project's additionality (also see chapter 3.3). Furthermore, the method and transparency of calculation of emissions that are to be compensated have been evaluated. One central aspect in this regard is the consideration of a Radiative Forcing Index (RFI) for airplane travelling. However, these aspects are not the focus of the paper and will therefore not be considered further.

Sterk and Bunse (2004) also consider customer orientated issues such as the type of confirmation. Identified options include a certification of "CO_2 neutrality" or the issuance of donation receipts. Besides that, some further parameters on the aggregated level as location of the project, category of project (sinks project or technical project) and category of underlying regulations (self-defined rules versus internationally accredited ones) are identified. The paper of Sterk and Bunse also aims to guide compensating entities in the selection of "high-quality compensation options" . The quality-issue will be discussed in more detail in chapter 2.3.2.

While it must be noted that it is close to impossible to identify all potential selection criteria as a result of a compensating entity's individual – and potentially hidden – objectives and preferences, the list of above-named criteria can be significantly expanded. In order to reduce complexity, the author proposes to differentiate between selection criteria on the one hand and indicators on the other hand. The approach is described in detail in section 2.4.

2.3.2 | Overview of major project characteristics

This chapter provides an overview of compensation projects' characteristics with relevance for selection choice of the compensating entity. The objective is to introduce relevant parameters and to provide background information, but not to rank or evaluate them, since this will be done in the subsequent sections. Relevant project characteristics are:

- quality of the project or project type,
- delivery of real emission reductions,
- project start date,
- environmental impacts and positive effects,
- support of sustainable development,
- (relative) costs of compensation,
- credibility of the compensation effort,
- visualisation to the public,
- fulfilment of regulative requirements and data availability,
- project type,
- situation in host country,
- quantity of emission reductions delivered,
- timing of delivery.

Quality of the compensation project or project type

It can be expected that the general interest of any compensating entity is to engage in a high-quality compensation project, no matter if the overarching driver of the entity is moral/environmental responsibility or economical benefits. In the former case, striving for high quality is part of "doing something good"; in the latter case it supports the marketing/image effect.

It must be noted that the term "high quality" leaves lots of room for interpretation and strongly depends on the stakeholder's value system. Interpreted strictly, it constitutes a concept, which can be materialized by indicators like delivery of real reductions, project type, etc. The concept of high-quality can be applied both to a specific project and to project types.

Environmental non-governmental organisations tend to define renewable energy and small scale projects as high-quality projects, while projects with regard to Land Use, Land Use Change and Forestry (LULUCF) – the so called sinks projects – are considered critical (e.g. WWF/Greenpeace 2000, CAN International 2002, FERN 2000). The attitude of scientists towards LULUCF projects is also diverse (Bodegom et al. 2000, Dutschke 2002/2005). Sterk and Bunse evaluate quality on the basis of project standards (= underlying regulative regime), project size and project type. Gold Standard and "small scale source sinks with significant benefits to local communities" are evaluated as quality options, while standards developed by the service provider and sinks projects are considered problematic to bad (Sterk/Bunse, 2004, p. 19).

On the project level, the following indicators might be applied to select high-quality projects:

– reasonable quantification of emission reductions,
– economic and political additionality of the project activity,
– independent verification of remission reductions,
– fulfilment of requirements of relevant regulations.

Delivery of real emission reductions

The two major factors for consideration with regard to the delivery of real reductions are a reasonable quantification of emission reductions and the economic and political additionality of the project activity.

For a reasonable quantification of emission reductions, the concept of baselines is of central relevance. As has been pointed out in chapter 1.2, a baseline is the reference scenario for the emissions situation in case the mitigation project was not implemented. Several assumptions have to be made to establish a baseline, e.g. with regard to remaining lifetimes of replaced installations/equipment (case of retrofit project), with regard to future emissions intensities for electricity generation in [kg/MWh] for a given grid (e.g. case of renewable energy project), or with regard to autonomous energy efficiency improvements. The baseline scenario has a strong influence on the quantity of emission reduction certificates that will be generated by a given project. Figure 3 schematically portrays the effects of two major parameters – time and extent of autonomous efficiency improvements – on the quantity of reduction certificates. Please note that the quantity of reduction certificates is equal to the integral between baseline emissions and project emissions.

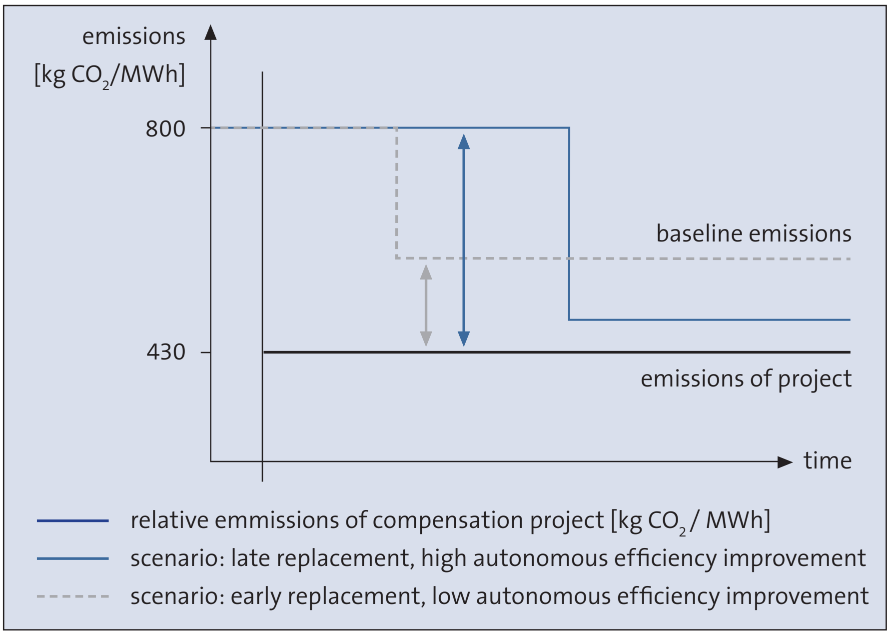


Figure 3: Influence of baseline choices on volumes of reduction certificates

As the baseline constitutes a counterfactual scenario, it will in most cases not be possible to check its correctness (Michaelowa, 2001). The ecological integrity of compensation effort therefore depends on a conscientious, conservative development of the baseline scenario. Further information is provided in chapter 3.3.

The concept of additionality is explained in general terms in the following paragraph, while chapter 3.3 gives an overview of additionality requirements under the CDM. As has been described above, baselines are used to quantify the environmental benefit of a given project in terms of GHG reduction. However, if baselines solely consider environmental aspects but do not assess whether the project activity is attractive for economical reasons, one might calculate emission reductions for something which would have happened anyway. The calculation itself might be fully correct. But, as the project would happen anyway, it does not entail an additional ecological benefit. If the overall objective is to keep the ecological integrity of compensation approaches, only such projects should be used that are "additional".

Several concepts have been proposed on how to determine a project's additionality with a special focus on CDM projects. Examples are Langrock et al. (2000), Greiner/Michaelowa (2003) and Michaelowa (2005). Further elaboration is given in chapter 3.3.

Project start date

It has been mentioned above, that the project start date (past/future) can be considered a major parameter. Braun and Stute point out: "At a first glance, it might look more respectable to invest in existing projects. From the ecological perspective, however, it might also make sense to invest in projects that did not start yet [...]. Thus, effectively new projects will be initiated." (Braun/Stute, 2004, pp. 9-10). This evaluation relates to the aspect of additionality.

Strictly interpreted, however, the start date can only be seen as a (strong) indicator of a project's additionality. Project developers might have included the expected income from sales of reduction certificates in their investment decision[8]. Hence, even projects that already started might be truly additional and deliver real emission reductions. It would thus be unreasonable to evaluate all projects that already commenced as non-additional and label them as "bad" projects. Instead, a case-to-case evaluation including the consideration of broader project circumstances is appropriate for practical purposes.

8 This argumentation is used in practice with regard to accreditation of CDM projects (e.g. PDD for CDM project Nova América Bagasse Cogeneration Project in Brazil, submitted February 2005). Also, the consolidated additionality test of the CDM EB asks project developers to "provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity" in cases where the crediting period is supposed to start prior to the project registration (UNFCCC 2004, p.1).

An early project start is also in line with the international CDM regulations. The Marrakech Accords and decision 18/CP.9 provide guidance on the eligibility of a proposed CDM project which started before registration. Project developers need to "provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity" (FCCC/CP/2003/6/Add.2).

Other positive environmental effects – air quality, soil quality, water quality, biodiversity

A GHG reduction project can lead to beneficial side-effects for the local and/or regional environment. An example hereof is the replacement of diesel generators for electricity generation by wind power. Not only do reductions of fuel consumption due to the project activity lower CO_2 emissions, but they also reduce emissions of local pollutants as NO_x, SO_2, noise, etc. At the end, the project also brings about health benefits for the local population.

The list of potential positive environmental side-effects can be very long; it also depends on local circumstances. A case-to-case evaluation will be necessary to identify the benefits of a given project activity. Typical positive side effects include:

– reduction of local air pollutants as NO_x, SO_2, Cl, Hg, dust, carbon black, noise, etc.;

– positive effects on the project area/surrounding as a biological habitat (e.g. number and variety of species, size of population);
– positive effects on major soil parameters, soil contamination, vegetation coverage, etc.;
– contribution to sustainable waste water management, substances of content, etc.

Support of sustainable development of host country

Positive side-effects of a GHG mitigation project with regard to the sustainable development of the host country can be manifold and strongly depend on the concrete project. Typical characteristics are that the project activity:
– leads to technology transfer to the host country;
– leads to positive effects with regard to international trade or market access[9] (indicators hereof can be increase of the regional/local gross national product, positive changes in income streams, etc.);
– meets or exceeds the sustainability criteria as defined by host country or as defined by international organisations.

9 It should be considered that the impact of a single compensation project often will be negligible on the national scale. Consequently, this parameter will only play a minor role in practice.

Costs of voluntary compensation

From the perspective of the compensating entity, costs of voluntary compensation are of major importance and will therefore constitute an important selection criterion. The financial determinants for the compensation effort are the quantity of compensated emissions [t $CO_{2\text{-eq}}$] and the relative price of reduction certificates [€/t $CO_{2\text{-eq}}$].

As has been discussed in chapter 2.2, different types of reduction certificates exist, depending on project type and certification regime. Prices per ton of CO_2 reduction depend on these categories and currently vary between 0.5 and 7.0 €/t CO_2. Some compensating entities such as the German Federal Ministry for the Environment obviously would be willing to pay up to 15-20 €/t $CO_{2\text{-eq}}$ for a high-quality project (Wandscher, 2004).

Table 3 gives an indication on needed financial budgets, depending on the price of certificates and the quantity of compensated emissions. To provide some reference: emissions resulting from the conference Renewables 2004 (travelling and energy consumption) were estimated to about 2.500 tons $CO_{2\text{-eq}}$ (Wandscher, 2004), while CO_2 emissions of Deutsche Telecom (Germany) only from travelling were estimated on 52.300 t in 2003 (Campino, 2004).

Compensated emissions [t $CO_{2\text{-eq}}$]	**Price per ton of emission reduction [€/t $CO_{2\text{-eq}}$]**							
	x 1	x 2.5	x 5	x 7.5	x 10	x 12.5	x 15	x 20
500	500	1,250	2,500	3,750	5,000	6,250	7,500	10,000
1000	1,000	2,500	5,000	7,500	10,000	12,500	15,000	20,000
2500	2,5000	6,250	12,500	18,750	25,000	31,250	37,500	50,000
5,000	5,000	12,500	25,000	37,500	50,000	62,500	75,000	100,000
10,000	10,000	25,000	50,000	75,000	100,000	125,000	150,000	200,000
15,000	15,000	37,500	75,000	112,500	150,000	187,500	225,000	300,000
20,000	20,000	50,000	100,000	150,000	200,000	250,000	300,000	400,000
50,000	50,000	125,000	250,000	375,000	500,000	625,000	750,000	1,000,000

Table 3: Costs of voluntary GHG compensation in dependence of certificate prices and emission volumes

Credibility of compensation effort

The credibility of the compensation effort is crucial if the compensating entity pursues image and/or marketing effects. Indicators for a high credibility of the mitigation project include the application of internationally accredited rules and an independent verification of emission reductions.

Visualisation to public

Comparable to the issue of credibility, a good visualisation to the public is important with regard to image and/or marketing effects. Indicators hereof might include a low level of technical complexity to make the approach understandable to the broad public, as well as a good public image. Interestingly, the service provider HEW (product "Green Events") came to the conclusion that sinks-projects are easier to communicate to the public than technical projects (Beeck, 2003).

Fulfilment of regulative requirements and data availability

A compensating entity may accept only those projects that fulfil the requirements of a given certification regime. If the entity, for example, decides to compensate its emissions by means of a CDM project, this project will have to fulfil the UNFCCC rules on baseline-setting, additionality, etc.

In this regard, the availability of data can become a relevant selection factor. The establishment of baselines and the additionality analysis for a given project strongly depend on solid data, which can also be verified by independent bodies (Butzengeiger/Michaelowa, 2005). Examples are market shares of a certain type/manufacturer of a technology (e.g. heating boilers) or the availability of long-term loans in a given country. At least with regard to CDM regulations, it is insufficient to "have a feeling on something" – facts and figures need to be provided (Krey, 2005).

In sum, availability of adequate data can be considered an important aspect for practical purposes. Bad or insufficient data can make a project fail to meet the requirements of an anticipated standard.

Situation in host country

The situation in the host country constitutes another relevant aspect for project selection. The three following aspects seem most significant:

– The risk profile of the host country, which influences the overall success probability of the compensation project. The OECD's Country Risk Classification or Country Corruption Indices might serve as indicators in this regard.
– The institutional situation in the host country – both in terms of public business administration (e.g. approval process for new installations) and in terms of compensation-specific procedures. An example for the latter category is the set-up of a "Designated National Authority (DNA)" as the official national approval body for CDM projects.
– Existing contacts to operators and/or partners of the compensation project, which can significantly improve an investor's trust in the project.

Project type

Various types of GHG compensation projects exist. The term "project type" itself can be interpreted in several ways. In this context, it is defined as the "technical" origin of greenhouse gas reduction as for example, energy efficiency improvements or fuel switch. Figure 4 gives an overview of major project types and sub-types.

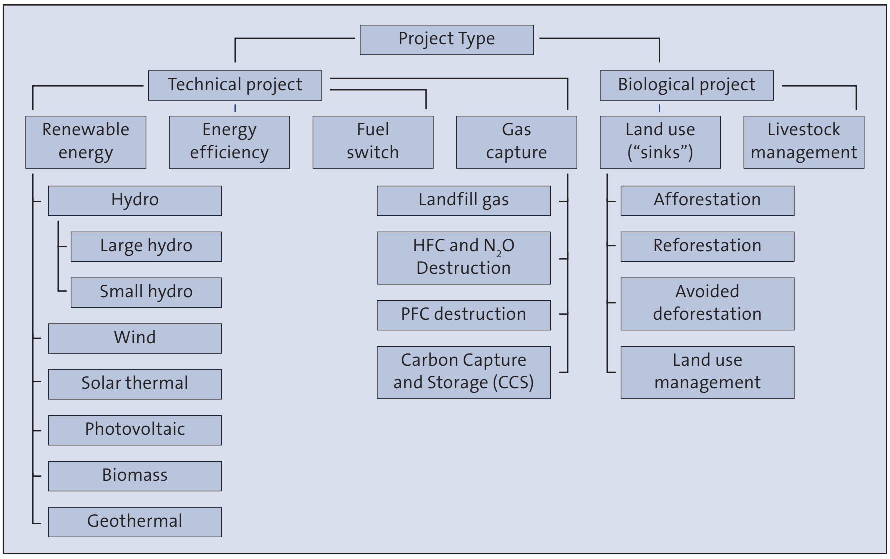


Figure 4: Types of compensation projects (non-exhaustive)

Quantity of emission reductions generated by project activity

The quantity of reduction certificates generated by a compensation project can be a major selection criterion; especially if a large volume of emissions is to be compensated. In those cases, it might be easier to select a single, “large” project that generates enough emission reductions than to select several “smaller” projects, which in aggregate generate as many reduction certificates as needed.

If a single-time-event is the object of compensation, this could be done with a smaller project that delivers equivalent reduction certificates over time[10]. If continuous emissions are to be compensated, it might be considered easier to choose a project that delivers the appropriate amount of *annual* reductions.

10 The issue of discounting of reductions to gain the same environmental benefit is not discussed within the scope of this paper.

Timing of delivery of reduction certificates

Compensation projects can have a more or less extended lead-time. The lead time is also influenced by the complexity and formalities of the underlying certification regime. Projects that are certified according to self-developed standards will generally have a lower formal lead-time than those projects that are certified according to extensive regulations such as the official CDM rules. The formal lead-time for the latter can be up to 2-2.5 years (Michaelowa, 2005a).

2.3.3 | Interactions between project characteristics

Most of the project characteristics identified in section 2.3 are not independent of one another. Figure 5 exemplarily visualises interactions between parameters. Table 4, p. 26, summarises relevant interactions systematically.

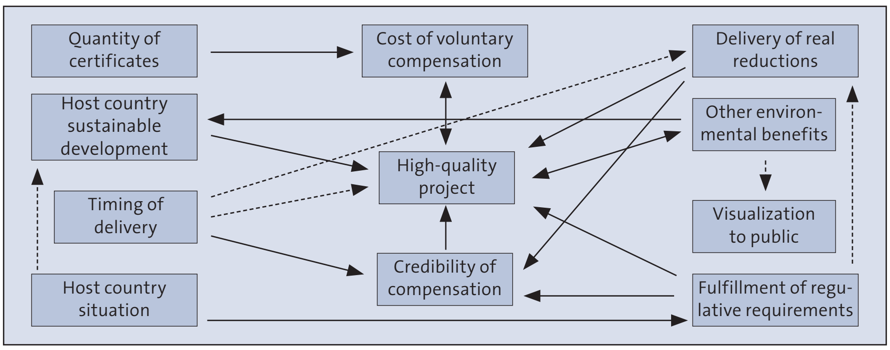


Figure 5: Interactions of project characteristics

Parameter in row [n] is indicated/influenced by parameter in	Real emission r eductions	Project start date	Other environ-mental benefits	Contribution sustain-able evelopment	Costs of voluntary compensation	Credibility of compensation	Fulfillment of regulations	Risk profile of host country	Institutional situation in host country	Project type
"High quality project"	X	(x)*	X	X		X	X			(x)**
Delivery of real reductions		(x)*					X			
Other environmental benefits										X
Contribution to sustainable development	X		X				(x)			(x)
Costs of voluntary compensation								X		X
Credibility of compensation	X	(x)*					X	X		
Visualisation to public		(x)	(x)	(x)						X
Fulfillment of regulative requirements		(x)		(x)					X	X
Project type					X					
Quantity of emission reductions generated							(x)	X		X
Timing of delivery		X							X	X

X = strong indicator, (x) = potential indicator
*case-by-case decision, **dependent on value system of CE

Table 4: Interactions between project characteristics

As interactions are manifold, it is not possible to conduct a comprehensive analysis within the scope of this paper. Instead, the relation between cost of voluntary compensation and project type and size are discussed exemplarily.

Costs of compensation and project type/size

There are three major factors influencing the price of emission reduction certificates and thus the costs of voluntary compensation. These are:

– technical reduction costs,
– transaction costs related to the generation of reduction certificates,
– the seller's expectations on income from reduction certificates.

Table 5 compares CO_2 reduction costs for different technologies for the case in Germany. Table 6 compares total installed system costs for renewable energy technologies. Both tables show that technical reduction costs strongly depend on the project type. While quantitative figures are variables that depend inter alia on the project's location (e.g. different costs for construction and labour; taxes, etc.), the structural differences due to the technology type remain.

€/t CO_2	min	max
Hydro Power	-25	120
Wind Power	26	75
Solarthermal	240	680
Heat Insulation Roof	0	220
Heat Insulation Wall	-60	400
Fuel Switch coal-gas	5	35
Biomass Power	40	120
Combined Heat + Power (CHP)	-118	128
Photovoltaics (PV)	490	1,040
Carbon Capture + Storage (CCS)	25	45

Source: Blesl et al. (2003), Rosenbauer (2005)

Table 5: Co_2 reduction costs for different technologies in Germany

System costs for renewable energy technologies in $/kW (2003)	2003	2013
Biomass co-firing with coal	300	180
Onshore Wind	1,000	700
Landfill Gas	1,200	1,000
Biogas (Anaerobic sewage treatment)	1,200	1,075
Biogas (Anaerobic animal waste treatment)	4,000	3,000
Geothermal	1,400	1,200
Biomass Gasification (CC)	3,550	1,200
Low-Impact Hydro (Canada Small)	2,400	1,800
Low-Impact Hydro (USA Small)	4,250	4,000
Mini Hydro	4,700	4,450
Parabolic Concentrated Solar Power	3,000	2,800
PV – Commercial	6,500	4,000
PV – Residential	9,000	5,000

Source: Frantzis (2003)

Table 6: Installed system costs for renewable energy technologies

As Michaelowa et al. (2003) point out with regard to CDM projects, transaction costs per unit of emission reduction strongly depend on the project size in terms of annual reductions. The range goes from 0.1 €/t $CO_{2\text{-eq}}$ for very large projects (more than 200,000 t CO_2 reduction per year), over 0.3-1 €/t $CO_{2\text{-eq}}$ for projects with an annual CO_2 reduction of 20,000-200,000 t and 100 €/t $CO_{2\text{-eq}}$ for mini projects (200-2,000 t $CO_{2\text{-eq}}$/year). For Photovoltaic projects with reductions of less than 200 $CO_{2\text{-eq}}$/year, transaction costs of 1,000 €/t are stated.

To conclude, there is a strong relationship between project type/size and relative costs of voluntary compensation. A compensating entity that focuses on cost-efficiency of the compensation might prefer large projects and low-cost technologies, e.g. landfill gas collection/flaring, geothermal energy or large hydro power. A compensating entity, which prefers renewable energy projects, e.g. photovoltaic electricity generation or mini hydro power plants, should be prepared to pay higher relative prices.

However, it is not possible to provide generally valid price indications because there are not only differences in mitigation and certificate generation costs, but also differences in the project developer's (sellers) strategy in terms of co-financing and profit expectations. Assume two identical projects A and B in terms of cost structures and volumes of reduction certificates generated. Project developer A strives for an Internal Rate of Return (IRR) of 8% and expects revenues from sales of reduction certificates to generate 50% of this. He thus offers certificates at a price of 10 €/t $CO_{2\text{-eq}}$. Contrary to that, project developer B offers certificates at a price of 20 €/t $CO_{2\text{-eq}}$, as he strives for a higher IRR and/or because he expects revenues from certificate sales to generate a larger share of the returns.

2.4 | Proposal for a project selection methodology

2.4.1 | Selection criteria and indicators

After the most relevant project characteristics have been presented and discussed in section 2.3, in this section a proposal for a project selection methodology is presented. The first important point is a differentiation between selection criteria and indicators. Section criteria are used to compare different projects with regard to pre-defined aspects; they work on a more or less aggregated level. Indicators help to evaluate a project's qualities either qualitatively or quantitatively; they thus constitute the basis for comparison. A selection criterion can be evaluated through one or several indicators; also see Figure 6.

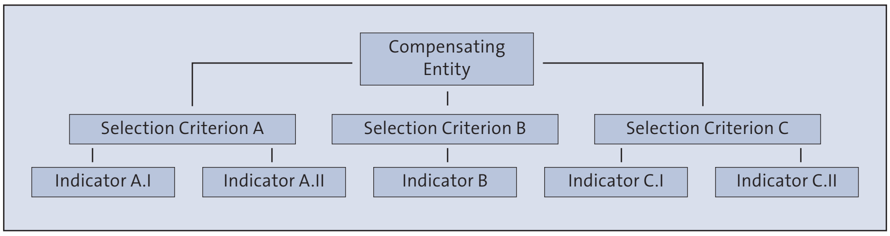


Figure 6: Concept of selection criteria and indicators

With regard to the project characteristics discussed in chapter 2.3.2, it is important to note that several of them can function both as a selection criterion and an indicator. Examples hereof are the start date of a project activity or qualification as Gold Standard. A selection criterion could be "only projects that did not start operation/construction yet", while it can also be an indicator for the selection criterion "delivery of real reductions".

The methodological differentiation between selection criteria and indicators also has practical relevance. Typical compensating entities might be strained by a large number of criteria. Therefore, a reduction to a limited set of selection choices seems advisable. However, if one would simply neglect some parameters, an incomplete picture of the project's qualities as well as unqualified and potentially wrong decisions would be the consequence. The following proposal therefore differentiates between aggregated selection criteria, on which a compensating entity will have to decide and indicators, which are used to evaluate projects in detail and to substantiate the selection process. This approach will limit the need for selection/qualified decisions by the compensating entity while at the same time securing the quality of the selection process.

Table 7 summarises the proposed categorisation of project characteristics into the categories selection criteria and indicators. They indirectly correspond to the drivers for voluntary compensation as identified in chapter 2.1. In practice, an adaptation of the listed indicators to the individual case might be necessary, because not all aspects are relevant for all project types.

Category	Selection criterion	Indicator(s)
Environmental benefits	Compensation of GHG emissions	Delivery of real emission reductions
		Project start date
		External verification of reductions
	Other positive environmental effects	Beneficial effects on: • local air quality • soil quality, water quality • biodiversity, and habitat
Social benefits	Contribution to sustainability of lifestyles and economy	Positive effects on sustainable development on host country
		Transfer of (innovative) technology
		Effects on international trade, market access, etc.
Economic implications	Economic feasibility	Costs of voluntary compensation
	Economic benefit (image effects, marketing)	Credibility
		Visualisation to public

Other	Certification regime	Fulfilment of requirements of relevant regulations
		Data availability
	Situation in host country/trust in project	Risk profile of host country
		Institutional situation in host country
		Existing contacts to operators/partners of compensation project
	Project type and location	
	Quantity of emission reductions generated	
	Timing of delivery of emission reductions	

Table 7: Selection criteria and indicators

2.4.2 | Hierarchy of selection criteria

It already has been pointed out that both drivers for and demands on voluntary compensation projects might differ significantly between compensating entities (CE). Thus, the definition of a fixed standard priority list of selection criteria is not reasonable[11].

With regard to the proposed methodology for project selection, selection criteria and indicators are assigned to three categories:

- Category I: selection criteria which can be taken as exogenous ramifications, e.g. limited financial budgets of the compensating entity.
- Category II: selection criteria and indicators which are dependent on the preferences of the CE. One can further differentiate between criteria with high, medium or low relevance for the decision of the CE.
- Category III: selection criteria which do not depend on the preferences of the CE, but which are relevant for practical purposes, e.g. with regard to the quantification and issuance of reduction credits. Examples hereof are data availability, both on the project and on host country circumstances, and data quality.

Category-I Criteria can act as threshold criteria. A project that does not adequately meet these demands will be disqualified from further consideration. Qualified projects will be evaluated in detail and compared with one another. This constitutes the basis for project selection by the compensating entity. The selection process can broadly be illustrated in Figure 7.

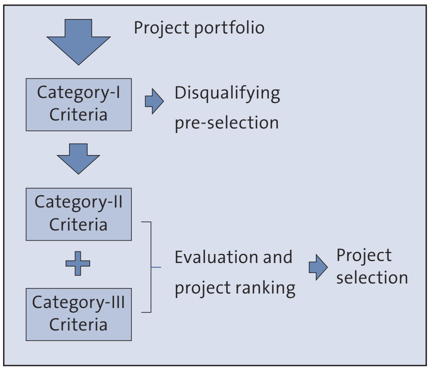


Figure 7: Schematic project selection process

Due to their special standing, the three parameters costs of compensation, project type and location, and certificate regime will be discussed in more detail. The common feature is their overriding importance on subsequent aspects, which can make them predetermining parameters.

Costs of compensation

The parameter of certificate price [€/t $CO_{2\text{-eq}}$] can be applied both as an exogenous ramification and as a selection criterion. In the following, it will be interpreted in both ways: as a selection criterion up to a pre-defined

11 One response option would be to construct categories of "typical compensating entities" with responding preference lists. It must be questioned, however, if practical demands of compensating entities could appropriately be reflected by such standard categories. Therefore, a more flexible methodology is proposed, also see chapter 2.4.3.

price limit. Once the price exceeds the threshold, it acts as a disqualifying parameter.

Project type and location

These parameters may (but do not have to) constitute exogenous ramifications due to the preference of the compensating entity.

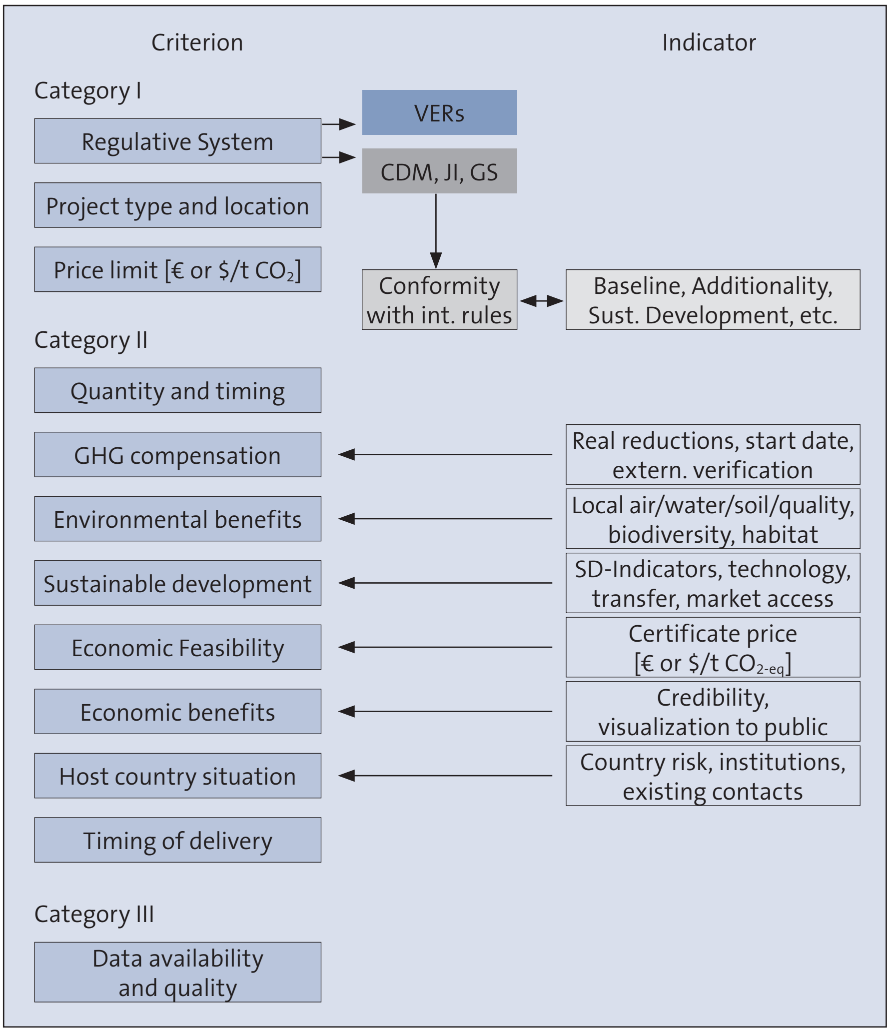
Certificate regime

The choice for or against a certificate category will influence the regulative requirements on the compensation project, or – vice versa – will exclude some projects/project types as they are not eligible under the given regime. For example, any decision for Gold Standard CERs will exclude LULUCF projects. A decision for regular CERs will pose additionality requirements on the project according to the standard CDM rules.

Basically, there are two options on how to handle this aspect. The first is to apply it as an exogenous ramification; the second is to use it as a (less relevant) selection criterion. In any case, it must be checked whether the project under consideration would be able to meet the requirements of the relevant regulations.

Within the proposed methodology for project selection, these three parameters can be applied as Category-I Criteria, if the compensating entity so wishes. However, it will also have the option to classify those parameters as endogenous. Details can be found in the next chapter.

Figure 8: Implications of decision for VERs versus CERs/ERUs



In the following, implications of the choice of the underlying regulative regime are illustrated. As mentioned above, this choice will influence the demands on the project. If self-developed standards are chosen (resulting in VERs), no international standards have to be considered. If JI First Track or GIS schemes are chosen, requirements primarily depend on the negotiations between host country and compensation entity. For JI Second Track projects, detailed rules and requirements still need to be defined on the international level. CDM projects will have to fulfil requirements with regard to baseline development, additionality, and contribution to sustainable development. For Gold Standard projects, similar but stricter demands are relevant as in the case of "regular" CDM apply.

To conclude, only if a compensating entity chooses self-developed standards/VERs, international rules do not need to be considered. This is also illustrated in Figure 8.

2.4.3 | Weighted evaluation of selection criteria

In order to account for individual preferences of compensating entities, a weighting of selection criteria is proposed. The underlying idea is that the compensating entity states its personal preferences for Category-II Criteria – e.g. demand on marketing effects, positive effects on sustainable development or the environment – which then constitute the basis for project selection.

Within this approach, a five-level scale is proposed. The compensation entity can define its personal relevance for each Category-II Criterion according to the scale presented below. Category-I Criteria can additionally be weighted with the factor 5, which then have a disqualifying character.

Weighting factor (w)	0	1	2	3	4	5 (Cat. I only)
Interpretation	Not relevant	Less relevant	Of average relevance	More relevant	Very relevant	Preclusive parameter*

* The project will be disqualified from further consideration, if requirement is not fulfilled in a satisfactory manner.

Table 8: Weighting factors w_n

2.4.4 | Quantification of qualitative indicators

Most of the indicators listed in Table 7 are of a qualitative nature; a few indicators – reduced air/water/soil pollution, price of certificates and project start date – are quantitative ones. With regard to the selection process, a (partial) quantification of the qualitative indicators is necessary. One approach hereof is to specify the gap between real project characteristics and the theoretical optimum for each indicator. A project that perfectly meets a certain indicator x_1 would receive a score of $s_1 = S_1$ for this indicator, while a project that fails to meet the requirement of indicator x_1 obtains a score of $s_1 = 0$. The maximum value of S_n depends on the indicator under consideration. Details are provided in Table 9. The performance of a project with regard to a given indicator should be based on expert judgement.

The overall rating (R) of a given project (P_m) is then determined by the sum of the achieved scores for all indicators (S_n), all of which are weighted according to the compensating entities value system/priorities (w_n).

$$R_{Pm} = \sum_{n=1}^{n} (w_n * S_n)$$

It must be noted that values for S_n also have a weighting function and therefore should be chosen carefully. Compensating entities that do have the expertise and time to set indicator values for their case would be free to do so. However, in many cases it can be assumed that one would expect too much from a compensating entity. Since it will define the values of the aggregated weighting scores wn (see chapter 2.4.3), its preferences clearly are considered.

Table 9 summarises the proposed values for S_n – differentiated by indicator and performance of a project – which will be used for the purpose of this paper. Dark shaded rows represent Category-II criteria, unshaded rows Category-I/-III criteria. The values given in Table 9 should be interpreted as a proposal by the author. They are based on best knowledge on CDM project evaluations while striving for a large degree of standardisation, but certainly reflect the author's personal value system to a certain extent.

The objective is to standardise the maximum score for each selection criterion to 1.0. Two exceptions were made: the criterion "compensation of GHG emissions" has a maximum score of 2.0 (delivery of real reductions max. 1.0 + project start date max. 0.5 + external verification max. 0.5). This results from the assumption that the compensation of GHG emissions is of significant importance for the compensating entity, regardless of its underlying drivers (also see chapter 2.1). Second, a negative scoring is possible for the criteria "environmental effects of the project activity", "economic benefits (marketing/image)" and "situation in host country" in order to allow consideration of negative aspects as well.

Table 9: Proposed scoring of quantitative indicators (S_n)

Selection criterion	Indicator	Proposed scoring S
Certification regime	Fulfilment of requirements of relevant regulations	0.0 - 1.0 success probability for accreditation
Project type	E.g. small scale, renewable energy, etc.	0.0 or 1.0
Project location	Preferred country	0.0 or 1.0
Certificate costs	Threshold costs	0.0 or 1.0
Compensation of GHG emissions	Delivery of real emission reductions	0.0 – 1.0 depending on reasonability of baseline, additionality assessment
	Project start date	0.0 – 0.5 commencement of operation ahead/ during/after accreditation process
	External verification	0.0 – no external verification is conducted 0.5 – external verification is conducted
Environmental effects of the project activity on:	• local air quality	-0.25 – 0.25 scope of negative or positive effect
	• soil quality	-0.25 – 0.25 scope of negative or positive effect
	• water quality	-0.25 – 0.25 scope of negative or positive effect
	• biodiversity / habitat	-0.25 – 0.25 scope of negative or positive effect
Contribution to sustainable development	SD criteria are met	0.0 – 0.5 if no/general/host-country specific SD-criteria are met*
	Transfer of (innovative) technology	0.0 – 0.3 depending on scope of technology transfer
	Effects on international trade, market access, etc.	0.0 – 0.2 significance of positive effects
Economic benefits (image/marketing)	Credibility	-0.5 – 0.5
	Visualisation to public	-0.5 – 0.5
Situation in host country	Risk profile of host country	-0.4 – 0.4 relative risk profile of host countries under consideration, for details see Annex I
	Institutional situation in host country	0.0 – insufficient situation 0.3 – sufficient situation (sliding scale)
	Existing contacts to partners of CE	0.0 – no contacts 0.3 – good contacts (sliding scale)
Other project risks	No/few risks	0.0 – 1.0
Quantity of emission reductions generated		0.5 – generation lower than demand 1.0 – generation equal to or higher than demand
Data availability and quality		0.0 – 1.0

* If no SD criteria are defined by the host country but project meets general SD criteria, a scoring of 0.5 results

An adaptation of the proposed matrix is possible in order to consider further specific requirements of the compensating entity.

2.4.5 | Summary

In this section, a methodology for the selection of compensation projects has been proposed. Its major features are the categorisation of project parameters in three categories, some of which can have a disqualifying character while others are weighted according to the compensating entities preferences. Selection criteria are substantiated by one or several indicators. Qualitative indicators will be quantified on the basis of relative performance and are scored with a range of 0.0-1.0. The evaluation of projects is then based on total scorings for all selection criteria (as sum of indicator scores); each multiplied by the relevant weighting factor.

Take the following example, which only accounts for the criteria "compensation of GHG emissions" and "other positive environmental effects". The compensating entity weighted the first criterion with 4, the second with 2. The project's performance on each indicator was determined by expert judgement as indicated in the table below. Multiplying each indicator's performance with the compensating entities' preference results in its weighted evaluation (WE Indicator). The weighted evaluation of a criterion (WE Criterion) is calculated by aggregating the scores of each indicator.

CE Preference	**Selection criterion**	**Indicator**	**max. score**	**Project Performance**	**WE Indicator**	**WE Criterion**
4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	0.20	0.8	
		Project start date	0.50	0.10	0.4	2.2
		External verification	0.50	0.25	1.0	
2	Environmental effects	• air quality	0.25	0	0.0	
		• soil quality	0.25	0.25	0.5	
		• water quality	0.25	0	0.0	
		• biodiversity, and habitat	0.25	0	0.0	0.5
				Total scoring	**2.7**	**2.7**

The proposed concept will be tested with the case studies in section 3.4.

3 | Case studies

3.1 | Background

In late 2002, the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH formulated the objective to become a "CO_2 neutral" operation. The GTZ is an internationally active organisation with its headquarter located in Eschborn/Germany. Major causes of GHG emissions are the extensive travelling activities of its employees as well as energy consumption in offices (electricity and heat). Several initiatives to reduce environmental impacts had been conducted, inter alia consumption of electricity from renewable energy sources, incentives to commute by public transportation or bikes, renovation of offices based on low-energy standards and the reduction of travelling activities by means of video conferences. However, the environmental balance sheet indicated that climate impacts remain. For 2003, a total of 10,742 t CO_2 (direct emissions) resulted from space heating (1,799 t CO_2), commuting (2,721 t CO_2), and national (394 t CO_2) and international (5,828 t CO_2) travelling activities (Wolf, 2004).

These emissions – plus a safety margin – were to be neutralized by a GHG-compensation project. The GTZ was to select an appropriate compensation project on the basis of short project descriptions, so-called project idea notes (PINs), and then to buy an option on the generated reduction certificates. Project planning, financing and implementation were to be conducted by third parties, i.e. the GTZ would not be involved in the physical project activity.

3.2 | Requirements of the compensating entity

The GTZ defined several requirements for an appropriate compensation project. These are:

- certified emission reductions,
- certification regime ((bilateral) CDM),
- project "size" (preferably small-scale),
- project type (preferably renewable energy project),
- quality aspect ("high-quality", potentially Gold Standard).

With regard to the driver categories identified in chapter 2.1, the GTZ can thus be assumed to be driven primarily by environmental and social aspects ("moral responsibility"). Certification requirements for CDM and potentially Gold Standard need to be fulfilled by the compensation project. If the project falls under the category of small scale, the simplified UNFCCC regulations can be applied.

According to these relatively broad preference statements, the author assumed preference scores w_n for each selection criterion. It must be noted that the values of w_n were not defined by the GTZ, thus they cannot be seen as an explicit GTZ position. Assumed values for w_n are summarized in Table 10.

GTZ	CE Preference	Selection criterion	Indicator
Category I	5	Certification regime	Success probability for accredidation as CDM project
	4	Certification regime II	Small Scale project and/or Gold Standard project
	3	Project type	Renewable Energy Project
	0	Project location	
	unknown	Threshold costs	€ or $/t
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)
			Project start date
			External verification
	2	Environmental effects	• air quality
			• soil quality
			• water quality
			• biodiversity, and habitat
	3	Contribution to sustainable development	SD criteria are met
			Transfer of (innovative) technologies
			International trade, market access, etc.
	2	Economic feasibility	Costs of voluntary compensation
	3	Economic benefit (image/marketing effects)	Credibility
			Visualisation to public
	2	Situation in host country	Risk profile of host country
			Institutional situation in host country
			Existing contacts
	2	Other project risks	No/few risks
	1	Quantity of emission reductions generated	
Category III	2	Data availability and quality	

Table 10: Assumed weighting scores w_n for the GTZ

Please note that a second row on certificate regime(s) has been added to allow inclusion of Gold Standard and Small Scale – eligibility. The methodology for the evaluation of the host countries' risk profiles is described in Annex I.

3.3 | Review: Major regulations for CDM projects

Before applying the selection concept to the case-studies, this chapter summarises the latest CDM rules with a focus on eligibility requirements. They are of outstanding importance for the underlying case, because the GTZ explicitly selected the CDM as the underlying certificate regime. Consequently, the success chances of a given project to be accredited as a CDM project will be crucial. The major aspects are:

– the additionality of the project,
– (no) involvement of Official Development Assistance,
– eligibility of the host country,
– regulations for baseline establishment.

Additionality Assessment

The major objective of the additionality assessment is to show that the project activity would not have occurred anyway, e.g. because of its economical attractiveness. On its 16th meeting, the CDM EB passed the "Consolidated Additionality Test" for CDM projects. It constitutes a tool for the demonstration and assessment of a project's additionality, which is not mandatory but should facilitate the additionality determination. The additionality test consists of several steps, namely:

– the identification of alternatives to the project activity,
– an investment analysis to determine that the proposed project activity is not the most economically or financially attractive,
– a barrier analysis (if results of step 2 are unconvincing),
– a common practice analysis,
– a discussion of the impact of CDM accreditation.

Further details can be found in Annex 1 of the Report of the 16th meeting of the CDM EB (UNFCCC, 2004). The Additionality Tool provides some guidance on the individual steps, but does not provide reference figures, e.g. on acceptable Internal Rates of Return (IRR). Individual circumstances of the potential project need to be considered.

For Small Scale Projects, a simplified additionality assessment – a barrier analysis – can be applied. The procedure is defined in attachment A to appendix B of the Small Scale Rules (UNFCCC, 2003). Investment barriers, technological barriers/risks/uncertainties, barriers due to prevailing practice or other types of barriers can be used for explanation. It must be shown that alternatives to the project would have led to higher emissions.

Official Development Assistance in the CDM

According to the decisions of the UNFCCC (Decision 17/CP.7), the CDM shall not lead to a diversion of Official Development Assistance (ODA). As is often the case in the international climate policy regime, the term "diversion" is not clearly defined. Dutschke et al. (2003) discuss different possible interpretations. These are: diversion of purpose, financial diversion, sectoral diversion, and regional diversion. So far, development assistance programmes in many countries have played a crucial role with regard to awareness-raising and CDM capacity building. Such support seems eligible under the CDM rules. The decisive practical questions are: "How much ODA is allowed and for which purposes?", and "How can diversion be detected?". As Dutschke et al. point out "it is not controversial today that ODA operates in the field of CDM institution and capacity building, like in the case of the World Bank initiated National Strategy Studies (NSS). These activities are financed on a bilateral basis and create the framework for successful project implementation. One result of these studies is a CDM project pipeline. The development of complete project documents is only one step further, which is actually undertaken by cooperation agencies of several countries (e.g. Canada and Germany), but this effectively moves into a grey zone where ODA might subsidise implementation." (Dutschke et al., 2003, p. 4)

If ODA is involved in a concrete project activity, the CDM EB has to decide on its eligibility. So far, there is no precedent. In any case, direct ODA involvement can be expected to decrease a project's chance for accreditation.

Host Country Eligibility

The potential host country must have ratified the Kyoto Protocol in order to be eligible for the CDM. This seemingly trivial formality had a political momentum until fall 2004. Several Non-Annex-I countries especially from OPEC did not ratify the Kyoto Protocol as long as Russia had not done so. Algeria is an example hereof. The Algerian President Bouteflika ratified the Kyoto Protocol in June 2004, but the ratification document was not sent to the UNFCCC – explained by the outstanding ratification of Russia (Wolf 2004a, Michaelowa 2005a).

Host country governments can decide which projects are eligible as CDM projects and which to be forwarded to the CDM EB for registration. The approval decision is made by the formal national CDM body, the so-called Designated National Authority (DNA), and has to be notified to the UNFCC Secretariat. Thus, the existence of a formal DNA should be considered as well. A DNA can set eligibility criteria for CDM projects. Examples hereof are the definition of sustainability criteria, the exclusion of certain project types, or the definition of "national priority lists" as in the case of China (Butzengeiger/ Michaelowa, 2005).

Regulations on baseline establishment

According to Paragraph 48 of the Marrakech Accords (Annex I, Section J), project developers may choose from amongst three baseline approaches "the one deemed most appropriate for the project activity, taking into account any guidance by the executive board, and justify the appropriateness of their choice:

a) existing actual or historical emissions, as applicable; or
b) emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; or
c) the average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category." (UNFCCC 2001, p. 79)

On the basis of these approaches, project developers have to submit proposals for a baseline methodology for the project under consideration unless an applicable methodology already exists (UNFFC, 2005b). Doing so, project developers also have to explain how the methodology demonstrates that a project activity is additional and therefore not the baseline scenario (UNFCCC, 2003a, p. 1). Submitted proposals are open for public comments and are evaluated by the so-called Methodology Panel and the CDM EB itself. While the Methodology Panel expresses recommendations to the CDM EB, the latter has the authority to approve proposed methodologies. After a slow start in 2003, 21 methodologies had been approved by the CDM EB by April 2005 (UNFCCC, 2005b).

One has to be aware that the selection criterion "success probability for accreditation under the chosen regime" will be influenced by far more than the above described issues. A case-by-case analysis is necessary to consider all of the manifold facets of the CDM. Expert judgment is recommended to ensure consideration of all relevant aspects and consistent entries into the selection matrix.

3.4 | Evaluation of submitted project idea notes

The selection methodology developed in section 2 will be tested at several case studies in the following paragraphs. Over 30 project idea notes have been submitted to the GTZ. For the purpose of the analysis, five of the more substantial project ideas were selected randomly. These are:

– a hydro power project in India,
– a wind energy project in northern Africa,
– a landfill gas project in northern Africa,
– a biological waste water treatment plant in South East Asia,
– an industrial fuel-switch project in South America.

The names of projects, involved project participants as well the exact locations are kept anonymous. The analysis is conducted on the basis of submitted PINs. Data, figures and assumptions in these documentations are not questioned within the scope of this study as long as there is no clear mistake/misinformation. Where appropriate, further background information on applied technologies etc. is added by the author. Neither technical feasibilities of the project ideas nor construction details are reviewed. For practical purposes, this would be of central relevance.

As a first step, major characteristics of each project are summarised. Thereafter, the performance of each project with regard to the selection criteria is discussed. Results will be summarized in matrices, which finally allow a project ranking. Thus, the relative project performance under the value system of the GTZ is compared. In general terms, the ranking constitutes the basis for project selection by a compensating entity.

3.4.1 | Hydro power project in India

Project overview

The proposed project is a hydroelectric power project in Karnataka state, India. It is a run-of-river utility with a total electric capacity of about 10 MW, being made out of three generation units. The plant consists of a diversion structure, a power canal of about 2000 m length, three penstocks, turbines, a power house, switch yard, tail race and a tail race canal. Generated electricity is supposed to be fed into the grid of the regional power transmission corporation. Therefore, a step-up of the voltage level is necessary.

A plant load factor of about 35% is expected, leading to an expected annual electricity generation of about 31,000 MWh.

Evaluation of project characteristics with regard to selection criteria

Certification regime(s)

The underlying project is a renewable energy project that fulfils the definitions of small scale projects according to CDM regulations. There, the category I.D – “Renewable Electricity Generation for the Grid” – applies. The project also has a very good potential to be accredited as a Gold Standard project. A stakeholder consultation process has been initiated in 2004 and, so far, no objections were raised. The nearby village issued the formally required “certificate of no-objection”. With regard to an environmental impact assessment (EIA), it is referred that no EIA has to be conducted according to Indian regulations because of the small scale character of the project activity. A “rapid EIA” had been conducted, which “did not indicate any negative impacts on air, water, soil and habitations”. It must also be noted that no extensive EIA has to be conducted to achieve Gold Standard Status because of the small scale character of the project (Sterk/Langrock, 2003, p. 10).

Project type and location

Renewable energy project, Non-Annex-I Country.

Compensation of GHG emissions

Reasonability of the baseline: the project developers propose the weighted average generation mix[12] in Karnataka State as the baseline, resulting in an emissions factor of 753 kg CO_2/MWh. Data of the Government of India (2003a) suggests that the order of magnitude is correct: in 2000-01, the weighted average emissions factor of the Karnataka State grid was 751 kg/MWh. However, it might be questioned as to whether the chosen baseline boundary (state boundaries of Karnataka) is appropriate. It might be reasonable to choose a wider baseline boundary, if inter-state transmission is relevant. The emissions factor for the "Southern Region of India" was 695 kg/MWh in 2001-02 according to the Government of India (2003a).

12 Mix of thermal, hydro and nuclear power. Wind energy power is not considered.

Additionality of the project activity: The project has an IRR of 14%, while typical interest rates on loans in the region are between 11.75 and 13.0%. A payback period of 8 years is indicated. Additionally, several barriers were identified; namely hydrology risks, geology risks, transmission risks, lack of infrastructure, and institutional barriers. The practical relevance of some of these barriers might be questioned. However, since the project would apply according to small scale rules, a simplified additionality assessment – and thus the identification of at least one barrier – is sufficient.

With regard to political/legal additionality, one should recognize that India formulated the objective to increase renewable energy power production to 10% of new capacity until 2012 – and that there is still a long way to go. On the other hand, it can be argued that no adequate incentives are provided by the Indian Government and that there are no negative implications for the project's additionality. As no public funding is involved, ODA additionality of the project can be assumed.

Project start date: The first draft of the PIN/PDD had been submitted in March 2004, while the project design phase started in October 2002. Clearances and formal approvals had been obtained by March 2003, the financial closure and land acquisition by June 2003. The power purchase agreement (PPA) with the regional transmission company was signed on September 15th 2003. Operation was expected to start in December 2004. The draft-PDD contains evidence that additional income through the CDM was considered by the project participants – but only since 2003. As the project design phase started in October 2002, this is a weak argument. The intended project duration is 30 years, the crediting period 10 years.

External verification: will be conducted as part of the CDM cycle.

To conclude, it can be assumed that the project's chances for formal approval are quite good, whereas the practical additionality must be questioned.

Environmental impacts

The project will not lead to a significant reduction of local air pollutants, since it is a Greenfield project and since nearby villages are already connected to the electricity grid. According to the baseline scenario, air pollution will be reduced on a regional scale (assumption of alternative power generation in fossil fuel fired power plants).

The project documentation does not contain information on negative impacts on habitats, water based populations or regional water balances. Since there is no diversion of the regional water balance, the impact on the regional water balance might be low. The former potential impacts should be analysed further. In this regard, the remaining minimum water level could be an appropriate indicator.

Contribution to sustainable development

The project activity does not lead to a transfer of technology – small hydro power plants are common practice in the region. However, the project can be assumed to have positive effects on local/regional infrastructure development, employment during construction and operation (35 permanent employees are envisaged), availability of electrical power and thus an increase of living-standards in the rural area[13] .

13 The issue of suppressed demand will not be discussed here.

Costs of compensation

Indication US$ 5 per CER; the price is subject to negotiation.

Economic benefits for the compensating entity

The project is characterised by a good image and it is easy to understand/communicate.

Situation in host country

India ratified (accessed) the Kyoto Protocol on 26th August 2002. The Ministry of Environment and Forests is the Designated National Authority for CDM projects. It has formulated interim guidelines for CDM and sustainable development demands. The overall institutional CDM situation in India can be considered excellent. Several CDM capacity building programmes have been conducted in India in the past. The above-mentioned baseline study of the Indian Government is a good indicator of its supportive attitude toward the CDM. Direct contacts to host country partners exist.

Country Risk Evaluation – Key Indicators

Country	Country Credit Ranking (Institutional Investor, 09/2004)*	Country Risk Classification OECD (06/2004)**	Country Corruption Index ***
India	53.0	4	2.8 (rank 83)

* For comparison: Switzerland = 95.2, Germany = 92.4, Argentina = 22.2

** 1 = lowest risk category, 7 = highest risk category

*** Finland: rank 1 (Score 9.7), Germany: rank 16 (Score 7.7)

Quantity of emission reductions generated

Up to 23,000 t CO_2/year (for an optimal year in terms of water availability).

Other project risks

Major project risks include limited water availability (dependency on monsoons; year-around operation is not possible) and the financial capabilities maintenance of the power purchase agreement (PPA). A PPA has been negotiated for 12 years. However, the financial standing of the purchaser is poor.

Data availability and quality

Very good, both with regard to the project activity and national/regional background information.

Case Study I India	CE Preference	Selection criterion	Indicator	max. score	Project Performance	WE Indicator	WE Criterion
Category I	5	Certification regime	Success probability for accreditaion as CDM project	1.0	0.85	4.3	4.3
	4	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.95	3.8	3.8
	3	Project type	Renewable Energy Project	1.0	1.0	3.0	3.0
	0	Project location		–	Non-Annex-I	–	–
	unknown	Threshold costs	€ or $/t	–		–	–
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	0.75	3.0	5.0
			Project start date	0.5	0.00	0.0	
			External verification	0.5	0.50	2.0	
	2	(Other) environmental effects	• air quality	0.25	0.2	0.4	0.2
			• soil quality	0.25	0	0.0	
			• water quality	0.25	0	0.0	
			• biodiversity, and habitat	0.25	-0.1	-0.2	
	3	Contribution to sustainable development	SD criteria are met	0.5	0.5	1.5	1.5
			Transfer of technology	0.3	0	0.0	
			International trade, market access, etc.	0.2	0	0.0	
	2	Economic feasibility	Costs of voluntary compensation	–	5 $/CER		
	3	Economic benefit (image/marketing effects)	Credibility	0.5	0.5	1.5	3.0
			Visualisation to public	0.5	0.5	1.5	
	2	Situation in host country	Risk profile of host country	0.4	0.22	0.4	1.4
			Institutional situation in host country	0.3	0.3	0.6	
			Existing contacts	0.3	0.2	0.4	
	2	Other project risks	No/few risks	1.0	0.65	1.3	1.3
	1	Quantity of emission reductions generated		1.0	1	1.0	1.0
Category III	2	Data availability and quality		1.0	1	2.0	2.0
					Total scoring	**26.5**	**26.5**

Table 11: Evaluation of case study I

3.4.2 | Wind energy project in North Africa

Project overview

The proposed compensation project is the installation of a wind park in Algeria. Ten wind turbines are to be installed, resulting in a total capacity of 10-13 MW. Based on wind speed analyses, an annual electricity generation of approximately 22,000 MWh is expected. Generated electricity is supposed to replace electricity from a nearby diesel fuelled installation (assuming that the region is not connected to the national electricity grid).

Evaluation of project characteristics with regard to selection criteria

Certification regime(s)

The project fulfils the definitions of small scale projects according to CDM regulations (installed capacity less than 15 MW). There, the category I.D – "Renewable Electricity Generation for the Grid" – applies. The project also has the potential to become accredited as a Gold Standard project. However, a public consultation process would have to be conducted. No public funds are involved in the project activity, thus a conflict with ODA additionality can be excluded.

Project type and location

Renewable energy project in the Saharan Region, Algeria (Non-Annex-I). The project location is a destination for regional and international tourism, which makes the project suitable as a "demonstration project".

Compensation of GHG emissions

Reasonability of the baseline: a comprehensive baseline still has to be developed. The project developers argue that the project activity replaces electricity from a nearby diesel fuelled installation (decentralized electricity generation). An emissions factor of 890 kg CO_2/MWh is assumed. If the area is connected to the national grid, however, one would need to consider the emissions factor of the latter. According to the statistics of the International Energy Agency (IEA, 2004), the Algerian emissions factor for heat and electricity generation was 697 kg CO_2/MWh in 2004. The effective emissions factor for pure electricity generation will be somewhat higher. The choice of the emissions factor significantly influences the total amount of CERs that can be expected by the project activity.

Additionality of the project activity: Algeria formulated the objective to generate 10% of its energy demand from renewable energies in 2020. There are no binding policies yet, which force utilities to generate a minimum share by means of renewable energies. However, the Algerian legislator recently initiated several acts to promote renewable energies in the country. A decree on diversification of power production costs was enacted on 25^{th} of March 2004 (Khelil, 2004). The renewable energy law will also entail a purchase obligation as well as a feed-in-tariff for renewable energy electricity of 9 ct/kWh. This feed-in-tariff will be considered in the following additionality assessment.

As the project is a small scale project, the simplified additionality assessment can be applied. Income streams of the project strongly depend on the generated electricity and thus the effective wind speed. However, no long-term measurements exist for the exact project location. The analysis of financial data indicated a payback period of 4.5 to 9 years depending on the effective wind yield. Detailed results of the sensitivity analysis can be found in Annex II. A potential barrier against project implementation is the political situation in the country. No ODA funds are involved.

Project start date: The PIN was submitted to the GTZ in November 2003. At that time, the project was in the very early design phase: wind yield studies still were to be conducted and the concrete technology (wind turbines) still had to be selected. The earliest possible implementation/start date was indicated for late 2004/early 2005. Consequently, one can assume that revenues from the CDM had been considered by project developers from the beginning.

External verification: will be conducted as part of the CDM cycle.

Environmental impacts

Compared with the baseline scenario of electricity generation by a diesel fuelled installation, electricity generation by wind power leads to a reduction of local air pollutants: up to 130 tons sulphur dioxide (SO_2), 50 tons nitrous monoxide (NO), 16 tons carbon monoxide (CO) and 4 tons of dust/particles can be avoided annually (assumption of 22,000 MWh electricity generation per year). The wind park will be installed in an area characterized by a low population density. Hence, few problems with regard to complaints from residents can be expected.

Contribution to sustainable development

Algeria's energy system is traditionally characterised by gas- and oil-based electricity generation. In 2002, 59.1% of electricity, which has been retailed by state-owned Sonel Gaz, had been generated using oil, 39.4% by using gas, 1.3% by using diesel and 0.2% by hydro power (Sonel Gaz, 2003). In total, 99.8% of electricity has been generated by conventional thermal sources (EIA, 2005). The government's objective to meet 10% of the national energy demand by renewable energies in 2020 still needs to be implemented. The project has the potential to become the national demonstration project for wind power generation, since no comparable project seems to exist in Algeria.

With regard to maintenance, two Algerian employees will be trained in Germany for 4 months and thereafter, are responsible for the installations. Thus, not only technology, but also some technical know-how is "transferred" to the host country (one might of course question the long-term benefits that effectively result from this transfer, but this issue is not the focus here).

Costs of compensation

No certificate price has been indicated; it is subject to negotiation.

Economic benefits for the compensating entity

The project is characterised by a solid image and it is easy to understand/communicate.

Situation in host country

The Algerian President internally passed the ratification document of the Kyoto Protocol in June 2004, and the document was submitted to the UNFCCC on February 16th 2005. Algeria is currently in the process of setting up a DNA, which so far has not been notified to the UNFCCC (UNFCCC, 2005/2005a). Eligibility criteria for the CDM and/or sustainability criteria have not yet been defined either. Direct contacts to host country partners exist.

Country Risk Evaluation – Key Indicators

Country	Country Credit Ranking (Institutional Investor, 09/2004)*	Country Risk Classification OECD (06/2004)**	Country Corruption Index ***
Algeria	40.2	4	2.6 (rank 88)

* For comparison: Switzerland = 95.2, Germany = 92.4, Argentina = 22.2

** 1 = lowest risk category, 7 = highest risk category

*** Finland: rank 1 (Score 9.7), Germany: rank 16 (Score 7.7)

Quantity of emission reductions generated

The amount of generated CERs strongly depends on the annual wind yield. Under the assumption of an electricity generation of 20,000 MWh/y and a diesel fuelled reference installation, 17,800 CERs/y are generated (13,600 CERs for the average grid emissions factor, IEA). If electricity generation amounts to 22,000 MWh/y, 19,590 CERs (14,960 CERs respectively) result.

Other project risks

The major uncertainty factor is the wind yield. The PIN does not contain information on whether there is prospect for a power purchase agreement. Based on the background of the Algerian feed-in-law, it can be assumed that a PPA can be negotiated without substantial problems.

Data availability and quality

Information on characteristics of the national energy system is sufficiently available; some further information on the project activity has to be gathered.

Case Study II Algeria	CE Preference	Selection criterion	Indicator	max. score	Project Performance	WE Indicator	WE Criterion
Category I	5	Certification regime	Success probability for accreditaion as CDM project	1.0	0.9	4.5	4.5
	4	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.8	3.2	3.2
	3	Project type	Renewable Energy Project	1.0	1.0	3.0	3.0
	0	Project location		–	Non-Annex-I	–	–
	unknown	Threshold costs	€ or $/t	–		–	–
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	0.80	3.2	7.2
			Project start date	0.5	0.50	2.0	
			External verification	0.5	0.50	2.0	
	2	(Other) environmental effects	• air quality	0.25	0.2	0.4	0.4
			• soil quality	0.25	0	0.0	
			• water quality	0.25	0	0.0	
			• biodiversity, and habitat	0.25	0	0.0	
	3	Contribution to sustainable development	SD criteria are met	0.5	0.5	1.5	2.4
			Transfer of technology	0.3	0.3	0.9	
			International trade, market access, etc.	0.2	0	0.0	
	2	Economic feasibility	Costs of voluntary compensation	–			
	3	Economic benefit (image/marketing effects)	Credibility	0.5	0.5	1.5	3.0
			Visualisation to public	0.5	0.5	1.5	
	2	Situation in host country	Risk profile of host country	0.4	0.14	0.3	0.9
			Institutional situation in host country	0.3	0.15	0.3	
			Existing contacts	0.3	0.15	0.3	
	2	Other project risks	No/few risks	1.0	0.5	1.0	1.0
	1	Quantity of emission reductions generated		1.0	1	1.0	1.0
Category III	2	Data availability and quality		1.0	0.75	1.5	1.5
					Total scoring	**28.1**	**28.1**

Table 12: Evaluation of case study II

3.4.3 | Landfill gas project in North Africa

Project overview

The proposed installation of a re-utilization system for a landfill in Tunisia aims at the elimination of methane emissions by gas collection and (potentially) re-utilization. If the methane content of the landfill gas is sufficient, electricity will be generated by small combined heat and power installation(s) with an electrical capacity of about 0,5 MW each. Details depend on the quality and quantity of the landfill gas. The latter is created by biochemical decomposition of the organic parts of solid household commercial waste that is disposed. About 65% of the disposed waste is biodegradable. So far, the landfill gas is released into the atmosphere. It typically contains 45-60% methane (WFAU, 2003), which has a global warming potential of 21. The project activity includes the establishment of a surface and lateral surface sealing and the installation of wells to vacuum the landfill gas.

GHG-emissions are reduced by two effects: methane is thermally oxidised and transformed to carbon dioxide with a global warming potential of 1. Thus, there is a reduction of 20 "global warming units". In addition, if the gas is not only flared but also used for electricity generation, CO_2 emissions from electricity generation can be reduced elsewhere. Details hereof depend on the baseline scenario.

Evaluation of project characteristics with regard to selection criteria

Certification regime

In principal, the project can be accredited as a CDM project. However, ODA funds might be involved (see below). The project would also qualify as a small scale project (Category III.D - methane recovery and avoidance), if both annual emission reductions and direct CO_2 emissions are lower than 15,000 tonnes of carbon dioxide equivalent annually. However, the estimated annual reductions are in the range of 33,000-45,000 t $CO_{2\text{-eq}}$ per year. The amount of emission reductions also varies over time due to fluctuations of the generated landfill gas (depending on biological activity and composition/decomposition of waste). Since total project emissions are larger than 15,000 tons/year, it is assumed that the project does not quality for the small scale category[14]. The project would qualify for the Gold Standard – category "Ecologically sound biomass, biogas and liquid biofuels (heat, electricity, co-generation)" – only partially and under the precondition that electricity indeed is generated (Schlup, 2005). Since the latter is not certain yet, non-eligibility is assumed in the following.

14 It must be noted that such cases are discussed on the contrary by CDM experts on the basis of guidance UNFCCC 2002 (Michaelowa 2005a); a final decision by the CDM EB is still pending.

Project type and location

Landfill gas utilisation, Tunisia

Compensation of GHG emissions

Reasonability of the baseline: The proposed baseline with regard to methane transformation is reasonable. A solid monitoring of the effective methane content is necessary, especially if no electricity generation is involved (backwards calculation on the basis of relative heating values of methane and carbon dioxide). If electricity generation is involved, a reasonable emissions factor has to be applied. Since it is intended to feed electricity into the national grid, the average national emissions factor could be applied. In 2002, average CO_2 emissions per MWh from electricity and heat generation amounted to 567 g (IEA, 2004). The effective emissions factor for pure electricity generation will be somewhat higher.

Additionality of the project activity: If the project only covers the collection and flaring of landfill gas without electricity generation, investment additionality is given. If, however, the gas analysis reveals that electricity generation is feasible, costs and income of the combined heat and power installations (CHP) need to be considered. The project proposal does not entail detailed financial data that would allow the application of the CDM EB's additionality tool. Project developers indicated that they strive for a payback period of less than seven years. There obviously is dispute on the feed-in-tariff for generated electricity: the grid operator offered a price which is 66% of what the project developer considers necessary. Significant political barriers cannot be expected since the Tunisian government actively supports the project activity and already initiated a public tender. A critical aspect is the potential involvement of GEF funds to bear incremental costs of the project. In this case, direct ODA funds would be involved – which significantly reduces the project's chances for accreditation at the CDM EB.

Project start date: Project developers proved that income from the CDM was considered from the beginning of project planning.

External verification: will be conducted as part of the CDM cycle.

Other positive or negative environmental impacts

Reduction of odours that might bother the local population.

Contribution to sustainable development

The project contributes to sustainable development as it supports the utilization of ecologically sound energy sources. The Tunisian government declared landfill gas utilization as being of "national interest". Technology transfer is involved to a certain extent.

Costs of compensation

No certificate price has been indicated.

Economic benefits for the compensating entity

The manner of GHG reduction is somewhat complex; landfills do not have a very good/positive image.

Situation in host country

Tunisia ratified (accessed) the Kyoto Protocol on January 22nd, 2003. The country has not yet notified a DNA to the UNFCCC (UNFCCC 2005a). Eligibility criteria for the CDM and/or sustainability criteria have also not been defined yet.

Direct contacts to host country partners exist.

Country	Country Credit Ranking (Institutional Investor, 09/2004)*	Country Risk Classification OECD (06/2004)**	Country Corruption Index ***
Tunisia	55.1	3	4.9 (rank 39)

Country Risk Evaluation – Key Indicators

* For comparison: Switzerland = 95.2, Germany = 92.4, Argentina = 22.2

** 1 = lowest risk category, 7 = highest risk category

*** Finland: rank 1 (Score 9.7), Germany: rank 16 (Score 7.7)

Quantity of emission reductions generated

33,000-45,000 t $CO_{2\text{-eq}}$ only for methane transformation/destruction.

Other project risks

Changes in composition of disposed waste, e.g. reduction of organic shares. Decrease of regional precipitation, which would reduce biological activity (dependence on H_2O) and thus the amount of biogas available for electricity generation.

Data availability and quality

Moderate data availability and quality with regard to the project's finances is rather poor.

Case Study III Tunisia	CE Preference	Selection criterion	Indicator	max. score	Project Performance	WE Indicator	WE Criterion
Category I	5	Certification regime	Success probability for accreditaion as CDM project	1.0	0.5	2.5	2.5
	4	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.0	0.0	0.0
	3	Project type	Renewable Energy Project	1.0	0.5	1.5	1.5
	0	Project location		–	Non-Annex-I	–	–
	unknown	Threshold costs	€ or $/t	–		–	–
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	0.5	2.0	6.0
			Project start date	0.5	0.5	2.0	
			External verification	0.5	0.5	2.0	
	2	(Other) environmental effects	• air quality	0.25	0.2	0.4	0.4
			• soil quality	0.25	0	0.0	
			• water quality	0.25	0	0.0	
			• biodiversity, and habitat	0.25	0	0.0	
	3	Contribution to sustainable development	SD criteria are met	0.5	0.5	1.5	2.1
			Transfer of technology	0.3	0.2	0.6	
			International trade, market access, etc.	0.2	0	0.0	
	2	Economic feasibility	Costs of voluntary compensation	–			
	3	Economic benefit (image/marketing effects)	Credibility	0.5	0.4	1.2	1.8
			Visualisation to public	0.5	0.2	0.6	
	2	Situation in host country	Risk profile of host country	0.4	0.40	0.8	1.5
			Institutional situation in host country	0.3	0.15	0.3	
			Existing contacts	0.3	0.2	0.4	
	2	Other project risks	No/few risks	1.0	0.7	1.4	1.4
	1	Quantity of emission reductions generated		1.0	1	1.0	1.0
Category III	2	Data availability and quality		1.0	0.5	1.0	1.0
					Total scoring	**19.2**	**19.2**

Table 13: Evaluation of case study III

3.4.4 | Biological waste water treatment plant in South East Asia

Project overview

The proposed project covers an adapted treatment system of waste-water from slaughterhouses and the utilization of collected biogas for the generation of heat and electricity. Both heat and electricity will be used internally, i.e. there is no electricity exported to the national/regional grid. The current waste water treatment system consists of an open anaerobic pond and an aeration pond. Methane is emitted continuously from the open anaerobic pond.

The plan of the waste water treatment system includes the installation of an anaerobic sludge blanket stirred batch system with a total digester volume of 4000 m_3 and a post treatment system consisting of sand bed filter and wetland system. Based on a chemical oxygen demand (COD) of 2.5 kg/m_3 and a current/future waste water flow of approximately 3,000/6,000 m_3/day the total daily COD amounts to about 7,500/15,000 kg per day. Under the assumption of an average biogas generation of 5,000 m_3/day (results in approximately 3.2 t CH_4/day), annual CH_4 reductions of 1,150 t are expected. Considering methane's global warming potential to be 21, about 23,000 t $CO_{2\text{-eq}}$ emissions per year can be reduced merely by methane destruction. A full-year operation of the slaughterhouse is assumed.

Evaluation of project characteristics with regard to selection criteria

Certification regime

The project qualifies for CDM status; given its investment additionality is confirmed by the CDM EB. Under the assumption that the project developers use a CHP installation to utilize the biogas, the project would qualify under category I.C – thermal energy for the user – of the small scale CDM rules: "For co-generation systems to qualify under this category, the sum of all forms of energy output shall not exceed 45 MW_{th}. E.g., for a biomass based co-generating system the rating for the primary boiler shall not exceed 45 MW_{th}." (UNFCCC, 2003, p. 7) If this way is chosen, it must be questioned if emission reductions from methane recovery can be accounted for. There have been some recent project submissions to the CDM EB, applying for two small scale categories. An example hereof is the Imbituva Biomass Project in Brazil (Ecosecurities, 2004, p.7). However, there is no decision yet on the eligibility of this approach; leading CDM experts are sceptical in this regard (Michaelowa, 2005a).

The project's eligibility for the Gold Standard must be questioned. While "ecologically sound" biomass/biogas is principally eligible, it must be expected that environmental NGOs will refuse projects with relation to battery farming (chicken slaughterhouse) in their Gold Standard project portfolio.

Project type and location

Biogas project, Non-Annex-I country

Compensation of GHG emissions

Reasonability of the baseline: As in the case of the Tunisian project, this project activity consists of two parts: destruction of methane that traditionally has been released into the atmosphere and the replacement of fossil fuels by utilization of the collected biogas. In accordance with the small scale rules, the simplified baseline is the fuel consumption of the baseline technologies times the respective emission coefficients for the fossil fuels displaced (in this case heavy oil). Emission reductions through electricity displacement are to be calculated by multiplying the electricity consumption with the relevant emission factor. For the methane recovery part, baseline is the amount of methane that would be emitted to the atmosphere (UNFCCC 2003, pp. 7, 17). Thus, the approach of the project developers can be evaluated as reasonable. A quantification of emission reductions due to fuel substitution is not possible as quantitative information has not been provided.

Additionality of the project activity: Financial data has been provided sparsely, so a comprehensive analysis is impossible. The biogas system would cost about 30 Mio Baht (installation only, no costs for operation and maintenance are given), savings through energy consumption – heavy oil and electricity – are estimated at 4 Mio Baht per year. Thus, in a best-case scenario (no operation and maintenance costs, no discounting; ignorance of costs for CHP), the pay back period would be 7.5 years. Investment additionality can thus be assumed. ODA funds are not involved in the project activity, finances are provided 100% by the operator if the installation. Also, there are no binding laws that would require operators of slaughterhouses to recover methane from waste water treatment installations.

Project start date: Project developers considered income from the CDM from the beginning of project planning.

External verification: will be conducted as part of the CDM cycle.

Other positive or negative environmental impacts

- Reduction of odours that might bother the local population.
- Improved quality of waste water after treatment, which also lowers pollutant loads to the river/canal.

Contribution to sustainable development

The proposed project does not involve technology transfer. Technologies are provided by a national supplier. However, it is the first time that this technology is applied in the underlying sector and can thus have demonstrative character. The project also contributes to sustainable development as it supports the utilization of ecologically sound energy sources.

Costs of compensation

4 EUR per CER

Economic benefits for the compensating entity

The manner of GHG reduction is somewhat complex. The image of the project can be negative as it implies acceptance of battery farming (chicken slaughterhouse).

Situation in host country

Thailand ratified the Kyoto Protocol in August 2002. Historically, its attitude towards CDM was not overwhelmingly enthusiastic. This attitude, however, has changed over time. Thailand notified its DNA to the UNFCCC in June 2004; the approval process for CDM project is complex (Michaelowa, 2003/2003a). Direct contacts to the project developers and host country representatives exist.

Country Risk Evaluation – Key Indicators

Country	Country Credit Ranking (Institutional Investor, 09/2004)*	Country Risk Classification OECD (06/2004)**	Country Corruption Index ***
Thailand	59.5	3	3.3 (rank 75)

* For comparison: Switzerland = 95.2, Germany = 92.4, Argentina = 22.2

** 1 = lowest risk category, 7 = highest risk category

*** Finland: rank 1 (Score 9.7), Germany: rank 16 (Score 7.7)

Quantity of emission reductions generated

Up to 22,000 t CO_{2-eq} depending on the amount of biogas generation; plus reduction from fossil fuel consumption.

Other project risks

Slow/bad adaptation of microbiology to waste water composition, resulting in incomplete/slow biodegradation and generation of biogas (assumed eventuality).

Data availability and quality

Medium to poor on the project activity, good with regard to the national situation.

Case Study IV Thailand	CE Preference	Selection criterion	Indicator	max. score	Project Performance	WE Indicator	WE Criterion
Category I	5	Certification regime	Success probability for accreditaion as CDM project	1.0	0.9	4.5	4.5
	4	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.4	1.6	1.6
	3	Project type	Renewable Energy Project	1.0	0.5	1.5	1.5
	0	Project location		–	Non-Annex-I	–	–
	unknown	Threshold costs	€ or $/t	–		–	–
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	1.0	4.0	8.0
			Project start date	0.5	0.5	2.0	
			External verification	0.5	0.5	2.0	
	2	(Other) environmental effects	• air quality	0.25	0.2	0.4	0.9
			• soil quality	0.25	0	0.0	
			• water quality	0.25	0.15	0.3	
			• biodiversity, and habitat	0.25	0.1	0.2	
	3	Contribution to sustainable development	SD criteria are met	0.5	0.35	1.1	1.1
			Transfer of technology	0.3	0	0.0	
			International trade, market access, etc.	0.2	0	0.0	
	2	Economic feasibility	Costs of voluntary compensation	–	4 €/t		
	3	Economic benefit (image/marketing effects)	Credibility	0.5	0.5	1.5	0.0
			Visualisation to public	0.5	-0.5	-1.5	
	2	Situation in host country	Risk profile of host country	0.4	0.34	0.7	1.7
			Institutional situation in host country	0.3	0.2	0.4	
			Existing contacts	0.3	0.3	0.6	
	2	Other project risks	No/few risks	1.0	0.75	1.5	1.5
	1	Quantity of emission reductions generated		1.0	1	1.0	1.0
Category III	2	Data availability and quality		1.0	0.5	1.0	1.0
					Total scoring	**22.7**	**22.7**

Table 14: Evaluation of case study IV

3.4.5 | Industrial fuel-switch project, South America

Project overview

The proposed project intends to generate emission reduction credits by means of fuel-switch in a large brewery in Argentina. Heavy oil will be displaced by sawdust derived from wood processing. The brewery uses two tube boilers, with a steam generation capacity of 17.5 t/h at 10 bars each. The oil-fired boiler under consideration historically has been kept as stand-by reserve. Within the scope of a production increase, the spare boiler will have to be fully used. Heavy oil consumption is expected to rise to 3,750 t annually.

Since enough biomass residues are available in the region, which usually are "fired to open air without any profit", the fuel switch was proposed. A technical adaptation of the boiler would be necessary to enable sawdust burning. This would be done by adding a special combustion air-sustained system called "torsional chamber". This technology is in widespread use in Latin America. The new aspect is that for the first time in Argentina a plant would be using biomass exclusively coming from another process/location. The project developers expect this to be "a trigger for being replicated somewhere else".

Evaluation of project characteristics with regard to selection criteria

Certification regime

If the project could prove its additionality, it will be eligible under the CDM (also see additionality discussion below).

The project activity does not qualify for category III.B of the Small Scale Rules – Switching fossil fuels, because the small scale category is limited to fuel-switches from one fossil fuel to another. Nonetheless, the project is eligible for category I.C – Thermal Energy for the User – of the CDM Small Scale Rules, since the threshold of 45 MW installed capacity is not surpassed by the boilers (co-fired system according to UNFCCC, 2005c, p. 1). It can also be assumed that the installations directly emit less than 15,000 tonnes of carbon dioxide equivalent annually.

Although it is a renewable energy project, it cannot be expected to qualify for the Gold Standard, due to the Gold Standard's stringent additionality requirements.

Project type and location

Renewable Energy Project, Non-Annex-I Country

Compensation of GHG emissions

Project start date: Project developers considered income of the CDM before implementation of the project. However, the project implementation time is very short: 1 month.

Additionality of the project activity: ODA funds are not involved. Since the project is not eligible for the simplified additionality test for small scale projects, the additionality tool of the CDM EB should be applied. Once again, only little financial data has been revealed by the project developer, which makes a detailed analysis difficult. However, a screening of macro-data clearly showed that the project is economically attractive.

Investment costs (torsional chamber) were given with US$ 750,000. Cost savings through the substitution of heavy oil by sawdust amount to 150 US$

per ton of oil, or 525,000 US$ per year. Thus, the payback period is only 15 months. To conclude, the project cannot be considered additional.

Reasonability of the baseline: Since the project is not eligible for the Small Scale Simplified Modalities, baseline rules for regular CDM projects have to be applied. As mentioned above, there is the choice between the baseline approaches "existing actual or historical emissions" (Paragraph 48a), "average of similar project's emissions" (Paragraph 48b) and "economically attractive alternative" (Paragraph 48c). The project developer argued for option 48a – the continuation of the status quo in terms of relative emissions. Without going too far into the details of baseline establishment, this approach poses two problems. First, the CDM EB's guidance on baseline establishment states "If a proposed CDM project activity seeks to retrofit or otherwise modify an existing facility, the baseline may refer to the characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output or lifetime of the existing facility. For any increase of output or lifetime of the facility which is due to the project activity, a different baseline shall apply" (UNFCCC 2003a, p. 2). Given the background of the intended production increase, there might be some who will argue that approach 48a is not allowed for this case. Second, the project developer has to demonstrate, through the baseline methodology, "that a project activity is additional and therefore not the baseline scenario (UNFCCC, 2003a, p. 1)". As had been shown in the paragraph on additionality, this will constitute a problem for the project activity. However, a baseline on the basis of approach 48c "most economically attractive alternative" does not make sense either. In this case the baseline would be the project activity and no CERs would be generated. The final option 48c "average emissions of similar projects" also causes problems: in the project idea note it was pointed out that the technology "is presently used in Argentina and other Latin American countries, such as Chile, Bolivia, Paraguay, Uruguay and Brazil, with very good results". Hence, there is the danger that, once again, the baseline is close to the project emissions after project implementation. A detailed statistical analysis would be needed to quantify figures. In sum, the establishment of an acceptable baseline might cause some problems. External verification: will be conducted as part of the CDM cycle.

Other positive or negative environmental impacts

Emissions of other pollutants through the uncontrolled burning of saw dust in mills will be reduced.

Contribution to sustainable development

The proposed project does not involve technology transfer.

Costs of compensation

A CER price has not been indicated in the project idea note.

Economic benefits for the compensating entity

The project is characterised by a solid image and it is easy to understand/ communicate.

Situation in host country

Argentina has ratified the Kyoto Protocol in December 2001 and has nominated the Secretary of Environment and Sustainable Development as the National Designated Authority (UNFCCC 2005a). The Argentine Government is also establishing a national evaluation system for CDM project proposals. National sustainability criteria have not yet been defined.

Country Risk Evaluation – Key Indicators

Country	Country Credit Ranking (Institutional Investor, 09/2004)*	Country Risk Classification OECD (06/2004)**	Country Corruption Index ***
Argentina	22.2	7	2.5 (rank 93)

* For comparison: Switzerland = 95.2, Germany = 92.4

** 1 = lowest risk category, 7 = highest risk category

*** Finland: rank 1 (Score 9.7), Germany: rank 16 (Score 7.7)

Quantity of emission reductions generated

Without checking for leakage effects, an annual CO_2 reduction of about 12,000 tons can be expected (Calculation: 3,750 tons heavy oil * 41 GJ/t = 152.8 TJ * 78 t CO_2/TJ = 11,993 t CO_2)

Other project risks

Unknown.

Data availability and quality

Moderate-good for project activity and host country.

Case Study V Argentina	CE Preference	Selection criterion	Indicator	max. score	Project Performance	WE Indicator	WE Criterion
Category I	5	Certification regime	Success probability for accreditaion as CDM project	1.0	0.0	0.0	0.0 Dysqualifying character
	4	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.5	2.0	2.0
	3	Project type	Renewable Energy Project	1.0	1.0	3.0	3.0
	0	Project location		–	Non-Annex-I	–	–
	unknown	Costs of compensation (threshold)	€ or $/t	–		–	–
Category II	4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.0	0.0	0.0	3.0
			Project start date	0.5	0.25	1.0	
			External verification	0.5	0.50	2.0	
	2	(Other) environmental effects	• air quality	0.25	0.25	0.5	0.5
			• soil quality	0.25	0	0.0	
			• water quality	0.25	0	0.0	
			• biodiversity, and habitat	0.25	0	0.0	
	3	Contribution to sustainable development	SD criteria are met	0.5	0.25	0.8	0.8
			Transfer of technology	0.3	0	0.0	
			International trade, market access, etc.	0.2	0	0.0	
	2	Economic feasibility	Costs of voluntary compensation	–			
	3	Economic benefit (image/marketing effects)	Credibility	0.5	0.25	0.8	2.3
			Visualisation to public	0.5	0.5	1.5	
	2	Situation in host country	Risk profile of host country	0.4	-0.12	-0.2	0.5
			Institutional situation in host country	0.3	0.2	0.4	
			Existing contacts	0.3	0.15	0.3	
	2	Other project risks	No/few risks	1.0	1	2.0	2.0
	1	Quantity of emission reductions generated		1.0	1	1.0	1.0
Category III	2	Data availability and quality		1.0	0.75	1.5	1.5
					Total scoring	**16.5**	**16.5**

Table 15: Evaluation of case study V

GTZ Preference	Selection criterion	Indicator	Case Study I		Case Study II		Case Study III		Case Study IV		Case Study V	
			WE Indicator	WE Criterion	WE Indicator	WE Criterion	WE Indicator	WE Criterion	WE Indicator	WE Criterion	WE Indicator	WE Criterion
5	Certification regime	Success probability for accreditation	4.3	4.3	4.5	4.5	2.5	2.5	4.5	4.5	0.0	0.0
4	Certification regime II	Small Scale project and/or Gold Standard project	3.8	3.8	3.2	3.2	0.0	0.0	1.6	1.6	2.0	2.0
3	Project type	Renewable Energy Project	3.0	3.0	3.0	3.0	1.5	1.5	1.5	1.5	3.0	3.0
4	Compensation of GHG emissions	Delivery of real emission reductions	3.0	5.0	3.2	7.2	2.0	6.0	4.0	8.0	0.0	3.0
		Project start date	0.0		2.0		2.0		2.0		1.0	
		External verification	2.0		2.0		2.0		2.0		2.0	
2	(Other) environmental effects	• air quality	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.9	0.5	0.5
		• soil quality	0.0		0.0		0.0		0.0		0.0	
		• water quality	0.0		0.0		0.0		0.3		0.0	
		• biodiversity, and habitat	-0.2		0.0		0.0		0.2		0.0	
3	Contribution to sustainable development	SD criteria are met	1.5	1.5	1.5	2.4	1.5	2.1	1.1	1.1	0.8	0.8
		Transfer of technology	0.0		0.9		0.6		0.0		0.0	
		International trade, market access, etc.	0.0		0.0		0.0		0.0		0.0	
3	Economic benefit (image/marketing effects)	Credibility	1.5	3.0	1.5	3.0	1.2	1.8	1.5	0.0	0.8	2.3
		Visualisation to public	1.5		1.5		0.6		-1.5		1.5	
2	Situation in host country	Risk profile of host country	0.4	1.4	0.3	0.9	0.8	1.5	0.7	1.7	-0.2	0.5
		Institutional situation in host country	0.6		0.3		0.3		0.4		0.4	
		Existing contacts	0.4		0.3		0.4		0.6		0.3	
2	Other project risks	No/few risks	1.3	1.3	1.0	1.0	1.4	1.4	1.5	1.5	2.0	2.0
1	Quantity of emission reductions generated		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	Data availability and quality		2.0	2.0	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5
	Total Scoring			**26.5**		**28.1**		**19.2**		**22.7**		**16.5**

Table 16: Results of case study evaluation

3.5 | Résumé

3.5.1 | Sensitivity of indicator scores S_n

Table 16 summarises the results of case study evaluations under the assumed value system of the GTZ. Case studies II and I (wind park in Algeria and small hydro power plant in India) are the top-performers and would thus be the first choices for the compensating entity. The wind park is characterised by a better performance with regard to delivery of real reductions (here: additionality) and contribution to sustainable development (hydro power as standard technology in India). On the contrary, India performs better with regard to the host country situation, especially with a view to CDM infrastructure.

Case study IV (biogas utilization Thailand) constitutes the medium-class. The major "deficiencies" of the Thai project are its unpopular image and the expected disqualification for Small Scale and Gold Standard Status.

Case studies III (landfill gas collection Tunisia) and V would not be shortlisted under the assumed preferences of the compensating entity. The Tunisian project suffers from bad performance in terms of success probability under the certification regimes (potential ODA involvement, public tender). Case Study V has the worst evaluation with regard to GHG mitigation, since the project can be considered as economically attractive. This criterion has a disqualifying character under the assumed value system of the GTZ.

It must be noted, however, that the evaluation has been conducted in a situation of incomplete information. Not all project proposals contained comprehensive data, especially with regard to finances. The (conservative) assumptions that have been made by the author might be disproved by reality. It was not possible to consider one of the major economic parameters – cost of compensation – because the certificate price was only indicated for two out of five projects.

3.5.2 | Sensitivity of weighting factors w_n

After having conducted five case studies for the assumed value system of the GTZ, a sensitivity test for the weighting factors (preferences of a compensating entity) is conducted in the following.

This is done by creating two fictitious compensating entities (FCE) with contrasting value systems. FCE 1 is supposed to focus on economic drivers, while FCE 2 focuses on environmental and social aspects. Therefore, the relevance of the criteria "certification regime(s), project type, reduction of GHG emissions, other environmental benefits and contribution to sustainable development" are scaled down/up (FCE 1: $w_n = 1$; FCE 2: $w_n = 4/5$), whereas the criteria "economic benefits, situation in host country, and other project risks" are scaled up/down (FCE 1: $w_n = 4$; FCE 2: $w_n = 1$). Table 17 and Table 18 summarise both applied values of weighting factors (w_n) and the results of project ranking under the changed value systems.

Preference FCE 1	Selection criterion	Indicator	Case Study I	Case Study II	Case Study III	Case Study IV	Case Study V
			WE Criterion	WE Criterion	WE Criterion	WE Criterion	WE Criterion
1	Certification regime	Success probability for accreditation as CDM project	0.9	0.9	0.5	0.9	0.0
1	Certification regime II	Small Scale project and/or Gold Standard project	1.0	0.8	0.0	0.4	0.5
1	Project type	Renewable Energy Project	1.0	1.0	0.5	0.5	1.0
1	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	1.3	1.8	1.5	2.0	0.8
		Project start date					
		External verification					
1	(Other) environmental effects	• air quality	0.1	0.2	0.2	0.5	0.3
		• soil quality					
		• water quality					
		• biodiversity, and habitat					
1	Contribution to sustainable development	SD criteria are met	0.5	0.8	0.7	0.4	0.3
		Transfer of technology					
		International trade, market access, etc.					
4	Economic benefit (image/marketing effects)	Credibility	4.0	4.0	2.4	0.0	3.0
		Visualisation to public					
4	Situation in host country	Risk profile of host country	2.9	1.8	3.0	3.4	0.9
		Institutional situation in host country					
		Existing contacts					
4	Other project risks	No/few risks	2.6	2.0	2.8	3.0	4.0
2	Quantity of emission reductions generated		2.0	2.0	2.0	2.0	2.0
1	Data availability and quality		1.0	0.8	0.5	0.5	0.8
	Total score		**17.1**	**16.0**	**14.1**	**13.5**	**13.4**

Table 17: Assumed weighting scores w_n and project ranking for FCE 1

Preference FCE 2	Selection criterion	Indicator	Case Study I	Case Study II	Case Study III	Case Study IV	Case Study V
			WE Criterion	WE Criterion	WE Criterion	WE Criterion	WE Criterion
5	Certification regime	Success probability for accreditation as CDM project	4.3	4.5	2.5	4.5	0.0
5	Certification regime II	Small Scale project and/or Gold Standard project	4.8	4.0	0.0	2.0	2.5
5	Project type	Renewable Energy Project	5.0	5.0	2.5	2.5	5.0
4	Compensation of GHG emissions	Delivery of real emission reductions (reasonable baseline, additionality)	5.0	7.2	6.0	8.0	3.0
		Project start date					
		External verification					
4	(Other) environmental effects	• air quality	0.4	0.8	0.8	1.8	1.0
		• soil quality					
		• water quality					
		• biodiversity, and habitat					
4	Contribution to sustainable development	SD criteria are met	2.0	3.2	2.8	1.4	1.0
		Transfer of technology					
		International trade, market access, etc.					
1	Economic benefit (image/marketing effects)	Credibility	1.0	1.0	0.6	0.0	0.8
		Visualisation to public					
2	Situation in host country	Risk profile of host country	1.4	0.9	1.5	1.7	0.5
		Institutional situation in host country					
		Existing contacts					
2	Other project risks	No/few risks	1.3	1.0	1.4	1.5	2.0
1	Quantity of emission reductions generated		1.0	1.0	1.0	1.0	1.0
2	Data availability and quality		2.0	1.5	1.0	1.0	1.5
	Total score		**28.1**	**30.1**	**20.1**	**25.4**	**18.2**

Table 18: Assumed weighting scores w_n and project ranking for FCE 2

Focus: Environmental and social drivers

In sum, the ranking order of projects indeed changes under different value systems. Consequently, the proposed methodology is sensitive towards applied weighting factors wn. One might argue that there is a moderate bias for "ecologically integer projects", i.e. an emphasis of the criteria "delivery of real reductions" and "certificate regime". However, given the initial assumption that all compensating entities have an interest to engage in high-quality projects (see p. 20 et seqq.), this can be considered reasonable.

If this bias was to be eliminated, one would also need to allow weighting values $w_n = 0$ and $w_n = 5$ for Category-II Criteria. In this case, the economically attractive case study V would lose its status as last-performer, also see Table 19.

Fictitious CE	Selection criterion	Case Study I	Case Study II	Case Study III	Case Study IV	Case Study V
		WE Criterion	WE Criterion	WE Criterion	WE Criterion	WE Criterion
0	Certification regime	0.0	0.0	0.0	0.0	0.0
0	Certification regime II	0.0	0.0	0.0	0.0	0.0
0	Project type	0.0	0.0	0.0	0.0	0.0
1	Compensation of GHG emissions	1.3	1.8	1.5	2.0	0.8
1	(Other) environmental effects	0.1	0.2	0.2	0.5	0.3
1	Contribution to sustainable development	0.5	0.8	0.7	0.4	0.3
5	Economic benefit (image/marketing effects)	5.0	5.0	3.0	0.0	3.8
4	Situation in host country	2.9	1.8	3.0	3.4	0.9
4	Other project risks	2.6	2.0	2.8	3.0	4.0
2	Quantity of emission reductions generated	2.0	2.0	2.0	2.0	2.0
1	Data availability and quality	1.0	0.8	0.5	0.5	0.8
	Total score	**15.3**	**14.3**	**13.7**	**11.7**	**12.7**

Table 19: Alternative weighting factors

3.5.3 | Conclusions

The proposed methodology for selection of compensation projects proved to be suitable to consider both project characteristics and individual value systems of compensating entities in a standardised manner.

The proposed matrix should not be interpreted as unalterable. Instead, an adaptation to the individual task may be appropriate. As an example, the indicator "external verification" was not influential for the given case because all CDM projects have to undergo an external verification. For other cases, however, this indicator could be helpful. The experience from the case studies also shows that:

a) expert judgement is necessary to comprehensively consider all project characteristics and arrive at a quantitative evaluation; and that
b) regardless of the predefined structures of the approach, a considerable degree of freedom is given to the evaluating expert.

Consequently, it is recommended that a given set of project proposals be evaluated by one and the same person. This enhances the consistency of results. Furthermore, quantitative results should not be interpreted too strictly. The methodology allows a grouping of projects, but not a direct ranking based on the second decimal point.

A further calibration of the proposed methodology would be possible by adapting the weighting scores w_n.

Finally, it must be noted that each evaluation can only be a snapshot of the current situation. Changes with regard to national circumstances, technical details/capacities of the proposed project etc. might quickly change the picture. Missing or insufficient data represents a problem as it might lead to wrong or at least incomplete assessments. Another issue is that the demands of a compensating entity might change over time. This can be due either to internal reasons, e.g. changed attitudes of the compensating entity, or due to the fact that the "perfect project" cannot be found. In the latter case, theoretical demands cannot be satisfied by practical supply. An adaptation of demands through the compensating entity might be the consequence. This aspect is an element of descriptive decision theory and is thus not considered further within the scope of this paper.

4 | Voluntary compensation and international climate policies

In this section, the impact of voluntary compensation on other climate policy systems in the time period 2005-2012 is discussed. Central questions are:

– Does voluntary compensation enhance the ecological effectiveness of (inter-)national climate policy regimes?
– Does voluntary compensation influence prices on greenhouse gas markets?

4.1 | Interactions with other climate policy systems

The first question in this regard is whether there are interactions between voluntary compensation and national or international climate policies at all. In the scope of this analysis, both the international climate policy system under the UNFCCC/Kyoto Protocol and the EU Greenhouse Gas Emission Trading Scheme will be examined, since these currently are the most important regimes with binding GHG emission targets.

As has been pointed out in chapter 2.2, different types of reduction credits may be used for voluntary compensation. The underlying certification regime for GHG reduction credits was identified as one major selection criterion. Interactions between voluntary compensation and (inter-)national climate policy systems depend on the underlying certificate regime and thus the selection through the compensating entity. In the following, it is differentiated between the Kyoto System and the EU ETS .

4.1.1 | Interactions with the Kyoto System

Interactions between voluntary compensation and the Kyoto System exist, if the compensating entity chooses a Kyoto compatible certification regime: Green Investment Schemes (project backed AAUs), Joint Implementation (CERs), or Clean Development Mechanism (CERs) – including all its sub-categories as Small Scale, Gold Standard, technical and sinks projects. If the compensating entity chooses Verified Emission Reduction Projects (VERs) there are no direct interactions. Although the first commitment period of the Kyoto Protocol commences only in 2008, there is a link with some compensation activities that are carried out today. Certified emission reductions from CDM projects, which are generated before 2008, can be "banked" into the first commitment period (Betz et al. 2001, p. 19). With regard to GIS schemes, options for AAUs can be issued for projects that are implemented today. Emission reduction units from JI projects can only be generated from 2008 onwards.

4.1.2 | Interactions with the EU ETS

Before interactions with voluntary compensation are discussed, a short review of the EU ETS and its background is given. As a response to increasing CO_2 emissions in Europe in the late 1990s (EEA, 2003), the European Commission published a Green Book on CO_2 emissions trading in March 2000. The EU ETS was supposed as a national policy to support the EU's compliance with its Kyoto target. After intense political negotiations, the emissions trading directive was passed in July 2003. The trading scheme formally started operation on January 1st 2005. This equals an implementation period of less than five years.

Major characteristics of the EU ETS are binding emissions targets for installations from energy intensive industries that exceed a certain capacity threshold, e.g. 20 MW thermal capacity for combustion installations. These installations need a general "permit" to emit greenhouse gases and obtain an allocation[15] of "EU allowances" representing its absolute emissions budget for a year/compliance period. Operators have to monitor their emissions according to the monitoring guidelines of the EU Commission (EU, 2004) and report them to their national authority until February 28th of the following year. Emissions have to be balanced by surrendering the responding amount of emission allowances. Allowances can be bought or sold on the market. They can also be banked into the next year – except from 2007 to 2008, since this represents the transition from the first to the second trading period of the EU ETS. If an operator fails to surrender a sufficient amount of allowances, penalties are imposed. In the first period, 40 €/t CO_2 have to be paid, in the second 100 €/t $CO_{2\text{-eq}}$. During the first period, the trading scheme is limited to carbon dioxide. Further Kyoto gases might be included in later stages (EU, 2003).

15 In 2005-2007, at least 95% of allowances are to be allocated free of charge, and at least 90% from 2008 onwards.

The so-called Linking Directive ("Amending directive of the EU-ETS in respect of the Kyoto Protocol's project mechanisms", EU 2004a) allows operators to use CERs from 2005 onwards and potentially credits from JI- and/or NCPs from 2008 onwards. The latter is subject to the review process of the EU-ETS scheduled for 2006. With regard to the inclusion of CDM, there is an exclusion of CERs from sinks, large hydro, and nuclear power projects. CERs from accepted projects will be transferred into allowances on a 1:1 ratio (EU 2004 a).

Further information on the background and design of the EU ETS is provided in AGE (2002, 2002a), Butzengeiger et al. (2004), (Zapfel 2001), Butzengeiger et al. (2003), Bode et al. (2003), or Christiansen et al. (2005).

Interactions with voluntary compensation exist, if the compensating entity chooses a compensation regime generating reduction certificates that are eligible under the EU ETS. Due to the limitations described above, these are currently only CERs stemming from technical projects (except nuclear power and large hydro power projects).

Table 20 summarises the above-described interactions.

	CDM		JI	GIS	NCP	VERs
	Technical projects	Sinks projects				
Kyoto before 2008	x	x	–	x	–	–
Kyoto 2008-12	x	x	x	x	–	–
EU ETS before 2008	x	–	–	–	–	–
EU ETS 2008-12	x	?*	(rather yes)	(rather no)	?	–

* considered in review-process 2005; also nuclear and large hydro

x = interaction exists – = no interaction

Table 20: Interactions of voluntary compensation with selected climate policy systems in dependence on the chosen certificate regime

4.2 | Effects on market prices and ecological effectiveness

For cases in which interactions between voluntary compensation and (inter-)national climate policy systems exist, the subsequent question is: what are the impacts on these systems? As a first step, effects are discussed quantitatively, while chapter 4.2.2 estimates quantitative effects, based on recent and expected volumes.

4.2.1 | Qualitative evaluation

Under the precondition that the compensating entity chooses a certification regime, which generates credits eligible under the Kyoto System and/or the EU ETS, voluntary compensation constitutes an additional demand for certificates.

With regard to market prices under these regimes, this generally leads to an increase in prices. Figure 9 illustrates this. The curves S and D represent the supply and demand in a market without additional demand through voluntary compensation. The market price for certificates is p_o. The increased demand as a result of voluntary compensation is presented through curve D_{VC}. Given a constant supply S, the market price will increase to p_1. Generally, the higher the additional demand through voluntary compensation, the higher market price.

The impact of voluntary compensation on the ecological effectiveness of the climate policy regimes is similar. Under the assumption that only real emission reductions generate reduction units, voluntary compensation will increase the deficit of emission certificates. Consequently, targeted entities have to find alternatives for reaching their emission targets. This can either be done through reducing own emissions or buying emission rights/reduction certificates. The latter alternative leads to an emission reduction elsewhere. Thus, an additional reduction of GHG emissions results in both approaches.

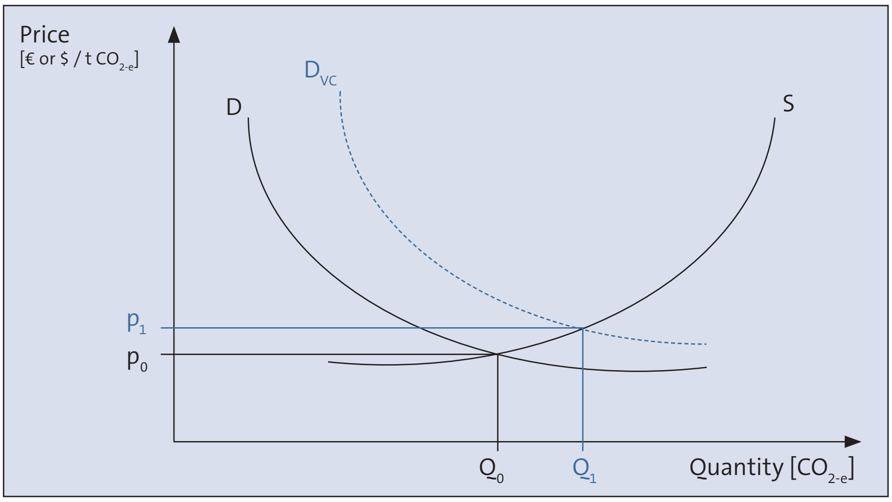


Figure 9: Qualitative effects of voluntary compensation on market prices under the Kyoto System/EU ETS

4.2.2 | Quantitative evaluation

This chapter attempts to evaluate the quantitative relevance of voluntary compensation in terms of ecological effectiveness and market prices of the climate policy regimes. This is done by comparing recent market developments and future estimates for voluntary compensation with those of the Kyoto System and the EU ETS.

Market developments: Kyoto System

An indicator for the demand of eligible certificates is the "distance to target", which is the difference between actual or forecasted GHG emissions and the defined emission targets.

The analysis of GHG emission trends of Annex-B countries of the Kyoto Protocol reveals that in several countries, GHG emissions have been strongly increasing instead of decreasing. Examples hereof are Australia (+22.2% from 1990 to 2002), Canada (+20.1%), Greece (+26.0%), Ireland (+28.9%), Japan (+12.1%), New Zealand (+21.6%), Portugal and Spain (+40.5% each), and the United States of America (+13.1%). However, these emission increases are offset by significant decreases in other Annex-B countries – mostly economies in transition. Russia, the Ukraine, Poland and Romania are those countries with the largest volumes of surplus emission rights when considering 2002 data. Trends in aggregate GHG emissions in 1990 and 2002 as well as targets under the Kyoto Protocol and distances to target are depicted in Table 21.

Million tons CO_2 equivalent Party	1990	2002	Change from 1990-2002 [%]	KP target [%]	KP target [million tons]	Distance to target [million tons]
Australia	430,513	526,042	22,2	8	464,954	61,088
Austria	77,746	84,621	8.8	-8	71,526	13,095
Belgium	146,067	150,311	2.9	-8	134,382	15,929
Bulgaria[a]	141,821	62,429	-56.0	-8	130,475	-68,046
Canada	608,704	731,209	20.1	-6	572,182	159,027
Croatia	31,609	27,962	-11.5	-5	30,029	-2,067
Czech Republic	192,019	144,217	-24.9	-8	176,657	-32,440
Denmark	68,750	68,491	-0.4	-8	63,250	5,241
Estonia	43,494	19,502	-55.2	-8	40,014	-20,512
Finland	76,770	81,963	6.8	-8	70,628	11,335
France	564,233	553,410	-1.9	-8	519,094	34,316
Germany	1,246,816	1,014,627	-18.6	-8	1,147,071	-132,444
Greece	107,149	134,992	26.0	-8	98,577	36,415
Hungary[a]	113,074	78,002	-31.0	-6	106,290	-28,288
Iceland	3,322	3,181	-4.2	10	3,654	-473
Ireland	53,418	68,875	28.9	-8	49,145	19,730
Italy	509,078	553,781	8.8	-8	468,352	85,429
Japan	1,187,269	1,330,793	12.1	-6	1,116,033	214,760
Latvia	28,921	10,756	-62.8	-8	26,607	-15,851
Liechtenstein	218	*218*	0.0	-8	201	17
Lithuania	50,134	17,215	-65.7	-8	46,123	-28,908
Luxembourg	13,448	10,833	-19.4	-8	12,372	-1,539
Monaco	73	96	31.5	-8	67	29
Netherlands	211,384	213,765	1.1	-8	194,473	19,292
New Zealand	61,640	74,976	21.6	0	61,640	13,336
Norway	52,136	55,343	6.2	1	52,657	2,686
Poland[a]	564,419	*382,791*	-32.2	-6	530,554	-147,763
Portugal	58,362	81,982	40.5	-8	53,693	28,289
Romania[a]	262,833	136,559	-48.0	-8	241,806	-105,247
Russian Federation	3,050,000	*1,876,000*	-38.5	0	3,050,000	-1,174,000
Slovakia	72,436	51,896	-28.4	-8	66,641	-14,745
Slovenia[a]	20,601	20,383	-1.1	-8	18,953	1,430
Spain	284,556	399,732	40.5	-8	261,792	137,940
Sweden	72,140	69,601	-3.5	-8	66,369	3,232
Switzerland	53,137	52,254	-1.7	-8	48,886	3,368
Ukraine	919,189	483,525	-47.4	0	919,189	-435,664
United Kingdom	742,639	634,858	-14.5	-8	683,228	-48,370

Table 21: Trends in GHG-emissions of Annex-B-Parties, 1990/2002

United States	6,129,118	6,934,562	13.1	-7	5,700,080	1,234,482
European Community[b]	4,231,442	4,123,618	-2.5	-8	3,892,927	230,691
Total without USA	12,120,118	10,207,191				-1,390,374
Total with USA	18,249,236	17,141,753				-155,891

a) In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988), Hungary (1985-87), Poland (1988), Romania (1989), Slovenia (1986).
b) Emission estimates of the European Community are reported separately from those of its Member States.
Source: UNFCCC (2004a), own calculations

As a first evaluation, one might conclude that the demand for further emission reductions (both in Annex-B countries and via CDM/JI) is zero. A simple transfer of Assigned Amount Units between Annex-B countries seems sufficient to make all Parties comply with their Kyoto targets. However, at least two further aspects need to be recognised.

First, the above data presents actual emissions, not those of the compliance period under the Kyoto Protocol. Thus, effective demand/surplus is subject to change[16]. Several model estimates on the volume of required emission reductions and/or the market size for CDM (and JI) projects have been published since the late 1990s. However, if one compares the results of these estimates, a remarkable variability of results can be realised, also see Box 2. This is primarily due to the incorporation of recent economic and political trends into younger estimates. An example of the latter is the official withdrawal of the US from the Kyoto System in early 2001.

16 Annex-I-Parties of the UNFCCC do have the obligation to submit national communications, which in future will also have to contain projections of emissions estimates up to 2020 for all sectors (IISD, 2004). However, the fourth national communications are due for submission only by January 1st 2006. IEA (2000, 2002) contain projections of CO_2 emissions for 2010 and 2020, but only by region and sector, not by country.

Box 2: Overview of estimates on reduction requirements and CDM/JI market size

Estimates of the CDM market size (overview)

A survey of the Inter-American Development Bank states the range of estimates on the CDM market size as 528 to 2,651 Mt $CO_{2\text{-eq}}$ in the Kyoto commitment period (IADB, 2002). One must note, however, that these estimates did not incorporate the withdrawal of the USA yet. Dhakal (2001) provides an overview of different forecasts for GHG emissions of Annex-B countries in the period 2008-12. The range is from +2.0% to +30% compared to 1990 (Dhakal, 2001, p. 3).
Jotzo et al. (2001) estimated the total demand for emission reductions in the first commitment period as 927 Mt CO_2 per year, of which 32% were expected to be generated by the CDM (297 Mt $CO_{2\text{-eq}}$ annually) and 8% by JI (78 Mt $CO_{2\text{-eq}}$ annually). This equals a total of 1,875 Mt $CO_{2\text{-eq}}$ in the 5-year Kyoto period. In a revised version of the model, the annual demand is estimated as 1.1 billion t $CO_{2\text{-eq}}$, to which the CDM would contribute 33% and JI 5% (Michaelowa and Jotzo, 2003).

Second, political strategies play an important role. These include e.g.:

- "buyer countries" wish for autonomy (no dependence on seller countries and their price policies),
- the option for "seller countries" to bank surplus AAUs into a potential next Kyoto period (more flexibility for upcoming target negotiations for the post 2012-period),
- other strategic behaviour by seller countries (willingness to sell), and
- international image (key word "indulgence trading").

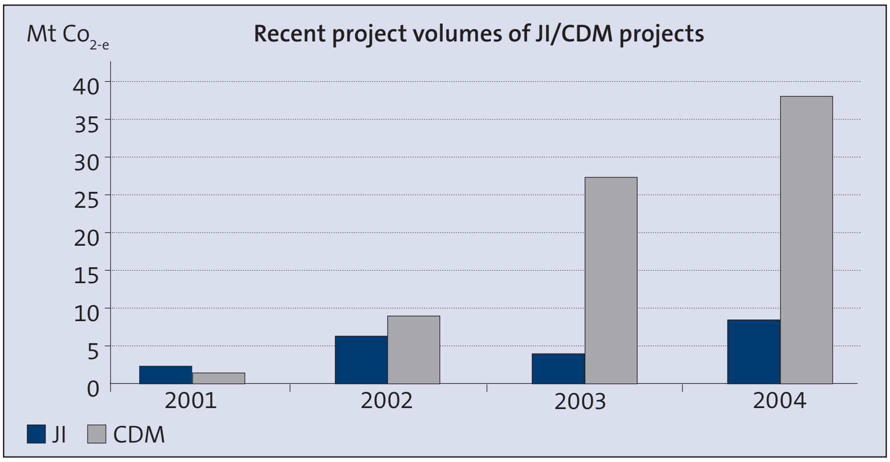
Strategies of this kind explain why there is actually a considerable demand for CERs and ERUs by Annex-B countries. Several buy-up programmes for reduction certificates from JI and CDM projects have been established in recent years both by Annex-B countries and international organisations/financial institutions such as the World Bank (WB) or the Asian Development Bank (ADB). In 2004, a total of 21 buy-up programmes had been implemented. This is a strong increase compared to 2002 and 2003, when 7 and 12 such programmes existed (De Dominicis, 2005). While these programmes differ with regard to investors (governmental programmes or private investors) and time horizon, all of them aim to generate CERs and/or ERUs through the investment in GHG reduction projects. The total financial volume of these programmes amounted to 1.547 billion Euro at the end of 2004. Under the assumption that 90% of these funds are used to buy reduction credits, and with average market prices of 4.0-7.0 € per CER/ERU (see Table 2), the total demand from the currently initiated programmes is in the range of 200 and 350 million CERs/ERUs until 2012. More detailed information on the structure and major characteristics of these programmes can be found in de Dominicis (2005).

Market developments: EU ETS

Demand for emission reduction certificates also comes from operators of installations that are targeted under the EU Greenhouse Gas Emission Trading Scheme, also see chapter 4.1.2. However, there currently are no publicly available estimates on this demand. This is due to the fact that the approval process of national allocation plans (NAPs) by the EU Commission was not finalised at the time of writing this paper. In March 2005, the EU Commission requested Poland to reduce its NAP by 140 million tons over the 2005 to 2007 period, which equals a reduction of about 16%. NAPs of other Member States, e.g. the United Kingdom, Italy or Greece, were not granted the final approval yet. Furthermore, allocation methods differed significantly in Member States, so that a common basis for comparison is difficult to establish. Some Member States like Germany allocated allowances on the basis of historical emissions, while others allocated on the basis of business-as-usual emission scenarios with varying assumptions. Further information on allocation processes can be found in Grubb et al. (2005), Betz et al. (2004) and Gilbert et al. (2004).

Market developments: JI and CDM markets

Data availability is better for the supply side. According to Point Carbon, contracted CDM and JI projects numbered about 38 and amounted close to 9 million tons $CO_{2\text{-eq}}$ in 2004. Trends since 2001 are depicted in Figure 10 (Point Carbon 2005; Tangen 2005). A strong increase in the CDM market size is expected: about 250 million CERs per annum by 2012 (Buen, 2005).



Source: Buen et al. (2005), Point Carbon (2005)

Figure 10: Recent trends of contracted project volumes of CDM/JI projects

Market developments: Voluntary Compensation

Studies on recent and/or expected volumes of voluntary compensation do not yet publicly exist. In order to estimate the market size of voluntary compensation, a survey among service providers has been conducted for the analysis. The underlying thought is that service providers themselves can be assumed to have deepest possible market insights and can thus provide a solid expert opinion. The overview of relevant service providers as given by Braun and Stute (2004, pp. 36-37) has been updated and was taken as the basis for the survey. In total, questionnaires were sent to 31 service providers. They can be assumed to represent the overwhelming share of the VC market. 18 of the interviewees responded. As two of them discontinued their services in the meantime, 16 answers remained for evaluation. It must be noted that not all interviewees answered all questions comprehensively, such that the effective number of answers available in some cases is lower.

Questions of the survey as well as responses are shown in Annex III; results are summarised in the following. A general observation is that until 2001, the VC market was clearly dominated by compensation by means of verified reduction projects. Five out of six service providers purely used VERs for compensation at that time. Since then, the amount of (new) service providers on the market, which use options of CERs/ERUs, increased. In 2004, only six out of the 16 were using 100% VERs for compensation. VERs clearly continue to dominate the market in absolute terms.

As can be seen from Figure 11, the overall volume of voluntary compensation increased steadily since 2001. Weighting service providers' declarations on typical shares of used certificate types with the underlying compensation volumes; it turns out that closely 95% of emission are compensated by means of VERs. CERs account for only 3.5%, ERUs to less than 2%[17]. When looking at the absolute volumes of VC as indicated in Figure 11, one should be reminded that only about 50% of the internationally known service providers participated in the survey.

17 It might also be interesting to note that about 3.5% of certificates stem from renewable energy projects, 68% from supply side projects, close to 13% from demand side projects, and close to 16% from sinks pro-jects (average of 2002-2004).

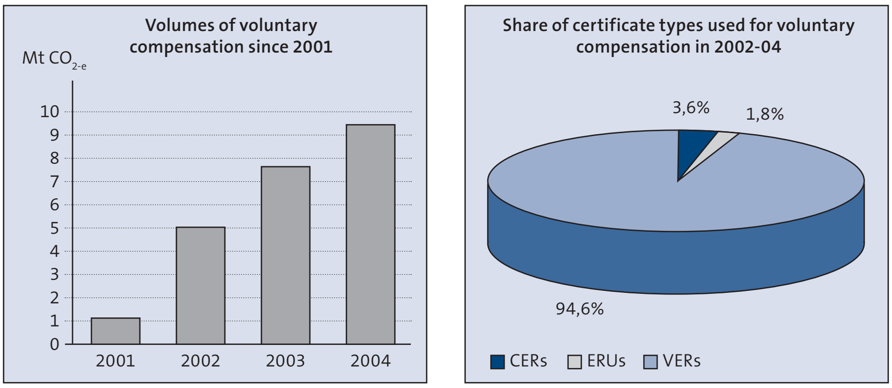


Figure 11: Voluntary compensation – volumes since 2001 and shares of certificate types

The interpretation of future expectations on VC volumes is not trivial due to two aspects. First, several service providers found it difficult to give such forecasts, and thus a few refrained from providing figures. This reduces the number of utilizable answers. Second, expectations on the future VC-market vary largely. As an example, projections for the annual demand in the period 2008-12 range from 50,000 to 50 million tons, also see Annex III.

Consequently, a strict arithmetic interpretation of the answers does not seem appropriate. Instead, rough estimates on expectable maximum CER and ERU volumes are derived as follows:

a) Consideration of the whole VC market

If estimates for the VC market as a whole are taken as the basis, the average expectation is roughly 1,360,000 t $CO_{2\text{-eq}}$ per annum for the period 2005-07, and 6,320,000 t $CO_{2\text{-eq}}$ per annum for the period 2008-2012. The most optimistic projection is 6 million and 50 million t $CO_{2\text{-eq}}$ per annum in the respective periods, also see Table 22.

Expected annual demand [t $CO_{2\text{-e}}$]	2005-07	2008-12
min max	20,000 6,000,000	50,000 50,000,000
average	1,360,000	6,320,000

Table 22: Estimates of market size for VC in 2005-07 and 2008-12

However, this is the total amount for reduction certificates from the CDM, JI and from Verified Reduction Projects. As the survey revealed, the current share within VC is 94.6% VERs, 3.7% CERs and 1.8% ERUs. If one assumes this share to remain constant in upcoming years, for the best-case-scenario an annual amount of 5.64 million VERs, 0.24 million CERs, and 0.12 million ERUs can be expected for the period 2005-07. For the period 2008-12, annually 47 million VERs, 2 million CERs, and 1 million ERUs can be estimated.

b) Consideration of the VC market share relevant for interactions with the Kyoto System and/or EU ETS

An alternative approach is to exclude all those service providers' estimations from the analysis that are characterised by 100%-VER-share. This exclusion can be justified since their activities do not interact with the Kyoto System or the EU ETS.

Following this approach, new estimates for the period 2005-07 result: annually about 1 million tons as the average and 4.5 million tons as the maximum value (see Table 23). It must be noted that no adequate figure can be given for the period 2008-12 since several interviewees refrained from providing such long-term estimates. Thus, data for long-term estimates is insufficient.

Expected annual demand [t $CO_{2\text{-e}}$], excluding 100%-VER-providers	2005-07	2008-12
min	20,000	50,000
max	4,500,000	(2,500,000)*
average	1,000,000	**

* some interviewees refrained from providing long-term estimates

** no average has been calculated due to insufficient data

Table 23: Estimates of market size for VC in 2005-07 and 2008-12 (excluding 100%-VER-compensation)

In addition, different shares of underlying certificate types emerge under this approach, see Figure 12. Taking these certificate shares and the maximum expectation for VC volumes as the basis, 1.85 million VERs, 1.8 million CERs, and 0.86 million ERUs per annum can be named as the estimate for 2005-07.

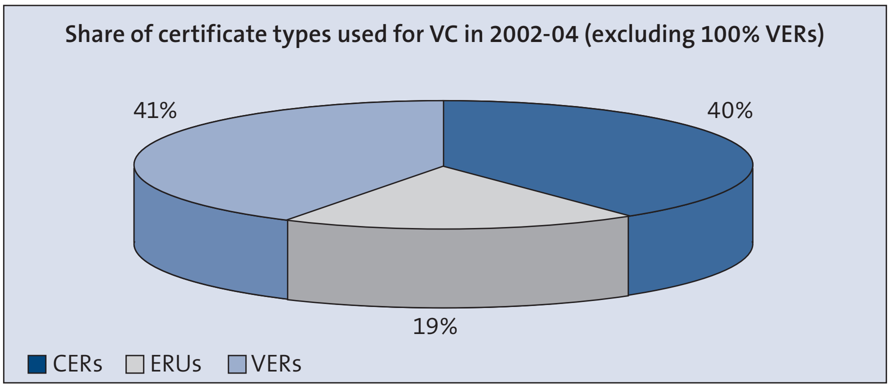


Figure 12: Shares of certificate types used for VC since 2001 (excluding 100%-VER-compensation)

To sum it up, a statistical interpretation of the responses to the survey is not possible due to insufficient data. As a rough estimate, expected certificate volumes used for voluntary compensation range from 0.25 to 2 million CERs and 0.1 to 0.9 million ERUs annually in the period 2005-07. One might want to add a safety margin of 100-200% to account for uncertainties or eventually increasing shares of CERs/VERs used for voluntary compensation.

Synthesis

If one compares expected volumes of the general CDM and JI markets with the estimates for CER/ERU volumes used for voluntary compensation in the period 2005-07, it becomes obvious that the order of magnitude differs significantly. This is portrayed in Figure 13. The share of VC in the international JI and CDM market is comparably low as the global share of renewable electricity in the overall electricity market.

Even under the most optimistic estimates for VC volumes as indicated in the survey (6 million tons $CO_{2\text{-}eq}$ per annum for the period 2005-07) and the assumption that only CERs and ERUs are used for compensation, the quantitative influence is low.

A similar conclusion has to be drawn, if estimates for CER/ERU volumes used for voluntary compensation are compared with the demand generated by the above mentioned buy-up programmes. The calculated demand of 200-350 billion CERs/ERUs until 2012 does not yet reflect the additional demand on company level that will be created by the EU ETS.

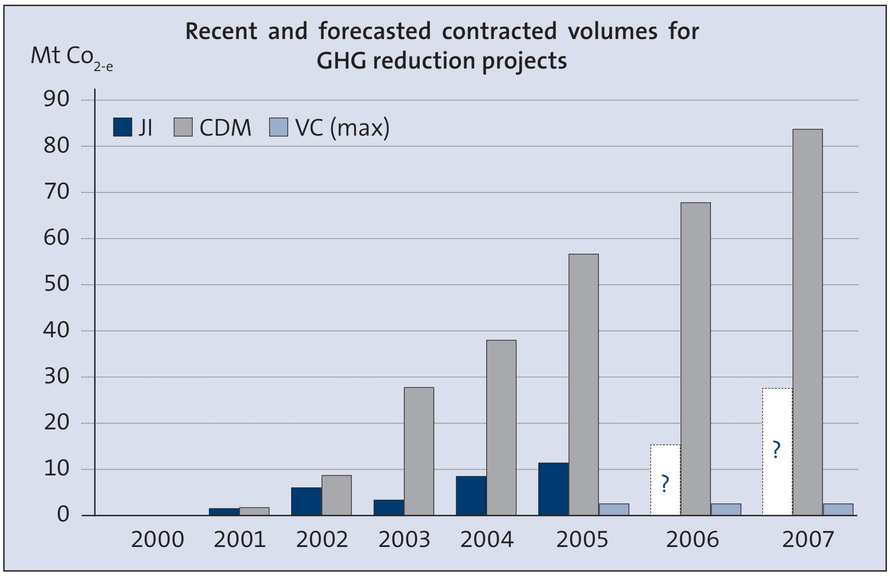


Figure 13: Recent and forecasted contract volumes for GHG reduction projects

Source: Point Carbon (2005a), own calculations

To answer the introductory questions of this chapter: "Does voluntary compensation enhance the ecological effectiveness of (inter-)national climate policy regimes? Does it influence prices on greenhouse gas markets?" – Theoretically yes, practically rather not, at least not for the time being. If this were to be achieved, awareness-raising programmes would have to be conducted. It would also be important to establish the public image that voluntary compensation can be an ecologically integer way of reducing one's own impact on the global climate system, if appropriate selection criteria are chosen.

What might act as a strong driver for voluntary compensation is the aspect of corporate liability with regard to climate change. Recently, Swiss Re – one of the globally leading reinsurance companies and the world's largest life and health reinsurer – announced plans to neutralise its CO_2 emissions. The underlying argument is that "corporate [...] liability on climate change is evolving perhaps more quickly than we'd like" (Swiss Re, 2003; Kecht, 2004). In February 2005, the Hongkong and Shanghai Banking Corporation Limited (HSBC) also announced plans to become "carbon neutral" as a consequence of the understanding that climate change represents "the largest single environmental challenge this century" (Dickinson, 2005).

5 | Annexes

Annex I | Methodology for evaluation of host countries' risk profiles

The applied method to quantify the qualitative indicator "risk profile of the host country" is a benchmark-approach that is only suitable for relative comparison of countries within a given group. It does not evaluate a country's absolute performance. Since the objective is to select a project out of a pre-defined group, it is sufficient to evaluate the relative performance of projects within that group.

The worst possible score is -0.4, the best possible score is 0.4 with a sliding scale. Three independent country ratings are considered: the Country Credit Ranking (regularly provided by Institutional Investor[18]), a Country Corruption Index, and the Country Risk Classification as provided by the OECD. The Country Credit Ranking value is transformed into an Index (CCR-Index) through diversion by 10 – i.e. the Indian Country Credit Ranking of 50 equals a CCR-Index-Value of 5.0. For each country, the total (column D) is calculated as:

$$D_i = A_i + B_i - C_i$$

The maximum total that has been reached by one of the countries under consideration sets the benchmark. Here, Tunisia performs best and sets the benchmark at 7.4 points. These 7.4 points constitute 100% of the scores possible (within the group of countries considered) and earn an indicator score Srisk_HC = 0.4 (column E).

$$S_{risk\ HC;\ i} = \frac{D_i}{D_{max}} * 0.4$$

	CCR-Index (Country Credit Ranking)	CC-Index (Country Corruption Index)	CRC-Index (Country Risk Classification)	Total score	Weighting Score S_{risk}
Country	*A*	*B*	*C*	*D*	*E*
India	5.3	2.8	4	4.1	0.22
Algeria	4.02	2.6	4	2.6	0.14
Tunisia	5.51	4.9	3	7.4	0.40
Thailand	5.95	3.3	3	6.3	0.34
Argentina	2.22	2.5	7	-2.3	-0.12
			maximum score	7.4	

18 Latest survey in September 2004; data taken from Sweeney et al. (2004)

As stated in chapter 3.4.2, the analysis of financial data indicated a payback period of 4.5 to 9 years depending on the effective wind yield. Details are provided in the three scenarios given below. Scenario I reflects the expected average wind yield of 22,000 MWh/year. Scenarios II and III state financial consequences of a respective 20% increase and decrease of the average wind yield.

Scenario I – Expected average wind yield (22,000 MWh/y)

Case Study II – Algeria

Provided information / assumptions	
Investment costs	8,000,000 US $
Annual maintenance*	75,000 US $
Repair years 1-10*	100,000 US $
Repair years 11-20	175,000 US $
Insurance fees*	50,000 US $
Discount rate	0.10
Electricity generation	**22,000** MWh/Year
Electricity price (income)	90.0 US $/MWh

[US $]	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Annual revenues	1,980,000	1,782,000	1,603,800	1,443,420	1,299,078	1,169,170	1,052,253
Total revenues since operation start	1,980,000	3,762,000	5,365,800	6,809,220	8,108,298	9,277,468	10,329,721
Management/administration costs	79,200	71,280	64,152	57,737	51,963	46,767	42,090
*Other expenses	225,000	202,500	182,250	164,025	147,623	132,860	119,574
Total operation costs	304,200	273,780	246,402	221,762	199,586	179,627	161,664
Profit in year n	*1,675,800*	*1,508,220*	*1,357,398*	*1,221,658*	*1,099,492*	*989,543*	*890,589*
Total profit since operation start	**1,675,800**	**3,184,020**	**4,541,418**	**5,763,076**	**6,862,569**	**7,852,112**	**8,742,701**

The payback period under this scenario is about 6.2 years.

Scenario II – +20% average wind yield (26,400 MWh/y)

Case Study II – Algeria

Provided information / assumptions	
Investment costs	8,000,000 US $
Annual maintenance*	75,000 US $
Repair years 1-10*	100,000 US $
Repair years 11-20	175,000 US $
Insurance fees*	50,000 US $
Discount rate	0.10
Electricity generation	**26,400** MWh/Year
Electricity price (income)	90.0 US $/MWh

[US $]	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Annual revenues	2,376,000	2,138,400	1,924,560	1,732,104	1,558,894	1,403,004	1,262,704
Total revenues since operation start	2,376,000	4,514,400	6,438,960	8,171,064	9,729,958	11,132,962	12,395,666
Management/administration costs	95,040	85,536	76,982	69,284	62,356	56,120	50,508
*Other expenses	225,000	202,500	182,250	164,025	147,623	132,860	119,574
Total operation costs	320,040	288,036	259,232	233,309	209,978	188,980	170,082
Profit in year n	*2,055,960*	*1,850,364*	*1,665,328*	*1,498,795*	*1,348,915*	*1,214,024*	*1,092,621*
Total profit since operation start	**2,055,960**	**3,906,324**	**5,571,652**	**7,070,446**	**8,419,362**	**9,633,386**	**10,726,007**

The payback period under scenario II is about 4.6 years.

Scenario III – -20% average wind yield (17,600 MWh/y) Case Study II – Algeria	
Provided information / assumptions	
Investment costs	8,000,000 US $
Annual maintenance*	75,000 US $
Repair years 1-10*	100,000 US $
Repair years 11-20	175,000 US $
Insurance fees*	50,000 US $
Discount rate	0.10
Electricity generation	**17,600** MWh/Year
Electricity price (income)	90.0 US $/MWh

[US $]	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual revenues	1,584,000	1,425,600	1,283,040	1,154,736	1,039,262	935,336	841,803	757,622	681,860	613,674
Total revenues since operation start	1,584,000	3,009,600	4,292,640	5,447,376	6,486,638	7,421,975	8,263,777	9,021,399	9,703,259	10,316,934
Management/ administration costs	63,360	57,024	51,322	46,189	41,570	37,413	33,672	30,305	27,274	24,547
*Other expenses	225,000	202,500	182,250	164,025	147,623	132,860	119,574	107,617	96,855	87,170
Total operation costs	288,360	259,524	233,572	210,214	189,193	170,274	153,246	137,922	124,130	111,717
Profit in year n	*1,295,640*	*1,166,076*	*1,049,468*	*944,522*	*850,069*	*765,062*	*688,556*	*619,701*	*557,731*	*501,957*
Total profit since operation start	**1,295,640**	**2,461,716**	**3,511,184**	**4,455,706**	**5,305,775**	**6,070,838**	**6,759,394**	**7,379,095**	**7,936,825**	**8,438,783**

The payback period under scenario III is about 9.2 years.

Annex III | Survey on volumes and project types of voluntary compensation

III-I Survey questions

1. Since when do you offer GHG compensation services (year/month)?
2. How many $CO_{2\text{-eq}}$ did you compensate in the years since operation started?
   1999: ________ t $CO_{2\text{-eq}}$ 2000: ________ t $CO_{2\text{-eq}}$
   2001: ________ t $CO_{2\text{-eq}}$ 2002: ________ t $CO_{2\text{-eq}}$
   2003: ________ t $CO_{2\text{-eq}}$ 2004: ________ t $CO_{2\text{-eq}}$
3. What are your expectations on the overall future annual demand for voluntary compensation?
   Period 2005-2007: ________ t $CO_{2\text{-eq}}$ per year
   Period 2008-2012: ________ t $CO_{2\text{-eq}}$ per year
   Beyond 2012: ________ t $CO_{2\text{-eq}}$ per year
4. Project portfolio of your product(s): What kinds of projects are used for compensation?

   Types of reduction credits:
   CDM projects (CERs):___% JI projects (ERUs):___% Other (VERs):___%

Project type:
- ___% Renewable energy projects
- ___% Supply side energy related reductions (e.g. fuel switch or energy efficiency improvement)
- ___% Demand side energy related reductions (e.g. efficiency improvement)
- ___% Sinks/LULUCF projects

Project size:
- ___% Small scale (according to CDM rules)
- ___% “Regular” scale
- ___% Large scale (more than 200,000 t CO_2/year)

III-I Overview of Responses										
	Question 1	Question 2							Question 3	
Response	[MM/YY]	1999	2000	2001	2002	2003	2004	2005-2007	2008-2012	after 2012
I	2002				407	914	5,160	200,000*	250,000,	300,000
II	2002				325	2,000	15,000	100,000	500,000	
III	1991	11,853	22,354	19,979	22,424	27,047	28,206			
IV	2003					400	5,000	500,000	2,500,000	5,000,000
V	2004						3,000	20,000	50,000	500,000
VI	2002				14,000	50,000	170,000	175,000	200,000	
VII	1999		125,000	0	250,000	0	500,000	100,000		
VIII	2002				2,500,000	3,000,000	3,500,000	4,500,000		
IX	1997				quantification “not possible”			2,500,000		
X	2003					4,000,000	4,000,000	“increasing”		
XI	1999	117,000	185,000	273,000	334,000	378,000	416,000	100,000	200,000	
XII	1997	70,000	70,000	70,000	125,000	125,000	125,000	6,000,000	50,000,000	500,000,000
XIII	1998									
XIV	1997			850,000	1,700,000	0	500,000	2,000,000	3,000,000	
XV	1999						6,000	300,000**	1,000,000	
XVI	2001			300	5,100	65,000	86,300	100,000	200,000	200,000

* Switzerland only ** Europe only

	Question 4a			Question 4b – Project type				Question 4c – Project size		
Response	CERs [%]	ERUs [%]	VERs [%]	Renewable Energy [%]	Supply Side [%]	Demand Side [%]	Sinks project [%]	Small [%]	Regular [%]	Large [%]
I	0	0	100	85	15	0	0	100	0	0
II	50	0	50	50	25	25	0	75	25	0
III	0	0	100	0	0	0	100	100	0	0
IV	35	15	50	60	20	20	0	50	40	10
V	100	0	0	50	0	50	0	100	0	0
VI	60	30	10	20	60	20	0	30	50	20
VII	0	0	100	33	0	33	33	100	0	0
VIII	highly variable			50	25	25	0	60	20	20
IX	60	20	20	25	25	25	25	20	50	30
X	0	0	100	0	95	2	3	0	100	0
XI	40	20	40	0	0	0	100	0	100	0
XII	0	0	100	0	0	50	50	100	0	0
XIII	0	100	0	0	0	0	100	0	0	0
XIV	0	0	100	10	0	60	30	0	0	0
XV	80	0	20	100	0	0	0	100	0	0
XVI	4	1	95	23	0	75	2	5	20	75

6 | Literature

AGE (2004) Bericht der Unterarbeitsgruppe 4 „Projektbezogene Maßnahmen“ an die Arbeitsgruppe Emissionshandel, Anhang 2: Diskussionspapier zu nationalen Ausgleichsprojekten; Endfassung vom 26.01.2004, Berlin, 2004.

AGE (2002a) Materialienband Phase I, Arbeitsgruppe „Emissionshandel zur Bekämpfung des Treibhauseffekts“, Berlin, 2002.

AGE (2002) Zwischenberichte der Unterarbeitsgruppen 1-4 der „Arbeitsgruppe Emissionshandel zur Bekämpfung des Treibhauseffekts“, Berlin, Dezember 2002.

Beeck, Hauke (2003) Personal communication with Hauke Beeck, project manager “Green Events” at Hamburg Electricity Company HEW/Vattenfall Europe, Hamburg, April 2003.

Betz, Regina; Gagelmann, Frank; Schleich, Joachim; Schmidt, Sebastian; Schön, Michael; Wartmann, Silke (2001) Flexible Instrumente im Klimaschutz – eine Anleitung für Unternehmen, Fraunhofer Institut für Systemtechnik und Innovationsforschung/Ministerium für Umwelt und Verkehr Baden-Württemberg/EnBW, Karlsruhe/Stuttgart, 2001.

Blesl, Markus; Remme, Uwe; Fahl, Ulrich (2003) Sustainable energy supply in Germany – scenario analysis with different CO_2 certificate prices; Presentation at International Energy Workshop, Luxembourg, 24.06.2003. University Stuttgart, Institute for energy economics and rational energy application.

Betz, Regina; Eichhammer, Wolfgang; Schleich, Joachim (2004) Designing National Allocation Plans for EU emissions trading – A First Analysis of the Outcomes, in: Energy & Environment 15 (3), pp. 375-423.

Bode, Sven; Butzengeiger, Sonja (2003) Zur kostenlosen Allokation von Emissionsrechten in Deutschland, in: Zeitschrift für Umweltpolitik und Umweltrecht, ZfU 3/2003, pp. 287-308.

Bode, Sven; Greiner, Sandra; Butzengeiger, Sonja (2002) Referenzszenarien. Eine offene Frage im Klimaschutz, in: Wirtschaftswissenschaftliches Studium (WiSt), 31 (2), pp. 111-113, Februar 2002.

Braun, Marcel; Stute, Elisa (2004) Anbieter von Dienstleistungen für den Ausgleich von Treibhausgasemissionen, Germanwatch-Hintergrundpapier, Bonn/Berlin, January 2004; download at: www.germanwatch.org/rio/thg-ad03.htm (March 9th, 2005).

Brim, O.G.; Glass, D.C.; Lavin, D.E.; Goodman N. (1962) Personality and Decision Processes, Studies in the Social Psychology of Thinking, Stanford University Press, Stanford/CA.

Buen, Jorund; Christiansen, Atle Chr.; Tangen, Kristian; Skogen, Anders (2005) 2003: The end of the beginning?, in: The Business of Climate Change – Corporate Responses to Kyoto, K. Begg, F. van der Woerd, D. Levy (eds.), Sheffield, UK.

Buen, Jorund (2005) CDM and JI: State of the market; presentation at conference Carbon Market Insights, Amsterdam, March 2005; download at: www.pointcarbon.com/wimages/1430_Jorund_Buen.pdf (April 4th, 2005).

Butzengeiger, Sonja; Michaelowa, Axel (2005) CDM in China – Critical Issues; contribution to the CDM-Handbook China; DEG / TÜV Rheinland Berlin Brandenburg, forthcoming.

Butzengeiger, Sonja; Michaelowa, Axel (2004) The EU Emissions Trading Scheme – Issues and Challenges, in: Intereconomics, Volume 39 No. 3, pp. 116-118, May 2004.

Butzengeiger, Sonja; Michaelowa, Axel; Bode, Sven (2003) Europe – a pioneer in greenhouse gas emissions trading. History of rule development and major design elements, in: Intereconomics, 38 (4), pp. 219-228, July 2003.

CAN (2002) Submission by CAN on issues related to modalities for including afforestation and reforestation under Article 12 of the Kyoto Protocol, 20th August 2002, download at: www.climatenetwork.org (March 9th, 2005).

Campino, Ignacio (2004) Geschäftsreisen und CO_2-Emissionen, Presentation at Clean Business Travelling, February 10th 2003, Dr. Ignacio Campino, Head of Corporate Sustainability and Citizenship, Deutsche Telekom Gruppe, Bonn.

CaPP (2002) Clean Development Mechanism – What is it? How does it work?, Climate Protection Programme for Developing Countries, Deutsche Gesellschaft für technische Zusammenarbeit (GTZ) GmbH, Eschborn.

Christiansen, A.C., A. Arvanitakis, Tangen, K.; Hasselknippe, H. (2005) Price determinants in the EU Emissions Trading Scheme, in: Climate Policy, 5 (1), Special Issue on the EU Emissions Trading System, London.

De Dominicis, Ariane (2005) Les fonds d'investissement dans les actifs carbone: état des lieux, Note d'étude de la mission climat de la caisse des dépôts, No 1 du 10 janvier 2005, Paris, download at : www.caissedesdepots.fr (April 28th, 2005).

Dhakal, Shobharkar (2001) CDM Market: Size, Barriers and Prospects, Institute for Global Environmental Strategies, Draft paper, January 2001 ; download at: www.iges.or.jp/en/ue/pdf/dhakal/dhakal_CDM.pdf (April 28th, 2005).

Dickinson, Paul (2005) Calling companies to account on climate, in: Environmental Finance, March 2005, pp. 20-21, London.

Dutschke, Michael (2005) Forestry and the ultimate objective of the Climate Convention, Hamburg Climate+ Paper 2/2005, Hamburg.

Dutschke, Michael; Michaelowa, Axel (2003) Development Aid and the CDM - How to interpret „Financial Additionality", HWWA Discussion Paper No. 228, Hamburg.

Dutschke, Michael (2002) Sustainable Forestry Investment under the Clean Development Mechanism: The Malaysian Case, HWWA Discussion Paper No. 198, Hamburg.

Ecoenergy (2004) Clean Development Mechanism Project Design Document Form (CDM-PDD) for Nova America Bagasse Cogeneration Project (NAB-CP), December 2004, Econenergy Ltd., download at: www.undccc.in/cdm/validation (April 11th, 2005).

Ecosecurities (2004) Clean Development Mechanism Small Scale Project Design Document (CDM-PDD) Imbituva Biomass Project, Parana – Brazil, August 2004, Ecosecurities Ltd., download at: http://cdm.unfccc.int/Projects/Validation/view.html?ProjectId=227455894132568003&OE=DNV-CUK (April 11th, 2005).

EEA (2004b) Greenhouse gas emission trends and projections in Europe 2004, EEA Report No 5/2004, European Environment Agency, 21st December 2004, Copenhagen, download at: http://reports.eea.eu.int/eea_report_2004_5/en (March 24th, 2005).

EEA (2004a) Kyoto target within EU's grasp if all planned measures and projects are implemented, projections show, News release, European Environment Agency, 21st December 2004, Copenhagen, http://org.eea.eu.int/documents/newsreleases/ghg_emissions-trends2004-en (March 24th, 2005).

EEA (2004) Impacts of Europe's changing climate, an indicator-based assessment, EEA Report 02/2004, European Environmental Agency, Luxemburg/Copenhagen, ISBN 92-9167-692-6, download at: http://reports.eea.eu.int/climate_report_2_2004/en (March 24th, 2005).

EEA (2003) Annual European Community greenhouse gas inventory 1990-2001 and inventory report 2003 (Final draft), Technical Report No. 95, Submission to the UNFCCC Secretariat, European Energy Agency, April 2003.

EIA (2005) Algeria Country Analysis Brief, Energy Information Administration, Official Energy Statistics from the U.S. Government, March 2005, download at: http://www.eia.doe.gov/emeu/cabs/algeria.pdf (March 29th, 2005).

EU (2004a) Amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004, Brussels.

EU (2004) Guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, COMMISSION DECISION of 29/01/2004, Brussels.

EU (2003) Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/ EC, 13 October 2003, Brussels.

FERN (2000) Sinking the Kyoto Protocol – the links between forests, plantations and carbon sinks, FERN Briefing Note, October 2000, United Kingdom, download at: www.greennet.apc.uk/fern (March 10th, 2005).

Frantzis, Lisa (2003) Global Power Markets –Why Should the U.S. Care? Presentation to: NREL/DOE/USAID Third Energy Analysis Forum. June 11th, 2003; download at: www.navigantconsulting.com (March 15th, 2005).

Gilbert, Alyssa; Bode, Jan-Willem Bode; Phylipsen, Dian (2004) Analysis of the national allocation plans for the EU emissions trading scheme; Ecofys UK, August 2004.

Government of India (2003a) Ministry of Power - Annual Report 2002-2003, Government of India, New Delhi, download at: www.powermin.nic.in (April 15th, 2005).

Government of India (2003) Baseline for renewable energy projects under the CDM – the report, Government of India, New Delhi.

Green Goal (2005) Unser globales Klima effektiv schützen – Klimaneutralität FIFA 2006; download at: www.greengoal.fifaworldcup.yahoo.net/de (April 14th, 2005).

Greiner, Sandra; Michaelowa, Axel (2003) Defining Investment Additionality for CDM projects - practical approaches, in: Energy Policy, 31, p. 1007-1015, revised version of HWWA Discussion Paper No. 106, (by Thomas Langrock, Axel Michaelowa, Sandra Greiner) Hamburg, November 2000.

Grubb, Michael; Azar, Christian; Peerson, U. Martin (2005) Allowance allocation in the European Emissions Trading System – a Commentary, in: Climate Policy, 5 (1), Special Issue on the EU Emissions Trading System, London.

Grütter, J.M. (2002) Greenhouse Gases Market Trends : 3rd quarter 2002; Grütter Consulting.

Hadley Centre (2004) Uncertainty, risk and dangerous climate change-Recent research on climate change science from the Hadley Centre, United Kingdom, December 2004.

Hansson, Sven Ove (1994) Decision theory – a brief introduction, Uppsala University, 1994-08-19, 95 pages, August 1994, download at: http://www.infra.kth.se/~soh/decisiontheory.pdf (May 16th, 2005).

IADB (2004) Climate Change in LAC: A Review of the Bonn and Marrakech Decisions and their effect on the Clean Development Mechanism of the Kyoto Protocol, Inter-American Development Bank, Sustainable Development Department, August 2004, download at: www.iadb.org (April 15th, 2005).

IEA (2004) CO_2-Emissions from Fuel Combustion – Highlights 1971-2002, IEA Statistics, 2004 Edition, International Energy Agency/OECD, Paris, France.

IEA (2002) Welt Energie – Ausblick 2002 – Schwerpunkte, International Energy Agency, Paris, France.

IEA (2000) World Energy Outlook 2000, International Energy Agency, Paris, France.

IISD (2004) Summary of the workshop on emissions projections from Annex-I Parties: 6-8 September 2004, Earth Negotiations Bulletin, Vol. 12 No. 243, International Institute for Sustainable Development, download at: http://www.iisd.ca/climate/wep/ (April 21st, 2005).

IPCC (2001) Climate Change 2001, the Scientific Basis, Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, United Kingdom, 2001.

IPCC (1996) Climate Change 1995 – The Science of Climate Change – Contribution of Working Group I to the IPCC Second Assessment Report, Cambridge University Press, UK.

Jotzo, Frank; Michaelowa, Axel (2001) Estimating the CDM Market under the Bonn Agreement, HWWA Discussion Paper No. 145, Hamburg.

Khelil, Chakib (2004) Keynote address at Renewables 2004 Opening Session, Chakib Khelil Minister of Energy and Mines, Algeria. Conference Renewables 2004, Bonn, download at: http://www.renewables2004.de/pdf/khelil_opening_en.pdf (June 1st 2004).

Knecht, Matthias (2004) Atmosphäre für Klimageschäfte. Weltbank und Finanzbranche setzen auf den Handel mit Emissionszertifikaten, Umweltschützer applaudieren, St. Galler Tagesblatt, 3. März 2004, download at: www.tagblatt.ch (April 15th, 2005).

Krey, Matthias (2004) Transaction Costs of CDM Projects in India – an empirical Survey; HWWA-Report 238, Hamburg.

Krombacher (2003) Krombacher Regenwald Projekt geht mit großem Erfolg zu Ende, Press Statement 13.08.2003, Krombach; download at: http://www.krombacher.de/infospresse/presse/ presse_view.php?id=79 (March 29th, 2005).

Langrock, Thomas; Michaelowa, Axel; Greiner, Sandra (2000) Defining Investment Additionality for CDM Projects – Practical Approaches, HWWA Discussion Paper 106, Hamburg.

Laux, Helmuth (2005) Entscheidungstheorie, Springer Verlag, XXIII, 484 pp., ISBN: 3540235760, January 2005.

Kokorin, Alexey (2003) Green Investment Schemes as a Way of Promoting Environmentally-Sound Co-operation among Russia, Canada, Japan and Other Nations under the Kyoto Protocol; IISD/CCKN-Paper by Alexey Korokon, WWF/Russian Climate Change Program, June 2003.

Michaelowa, Axel (2005a) Personal communication with Dr. Axel Michaelowa, Head of the Research Programme International Climate Policy at Hamburg Institute of International Economics, Hamburg, April 2005.

Michaelowa, Axel (2005) Determination of baselines and additionality for the CDM: a crucial element of credibility of the climate regime; in: Yamin, Farhana (ed.): Climate change and carbon markets. A handbook of emission reduction mechanisms, Earthscan, London, pp. 289-304.

Michaelowa, Axel; Krey, Matthias; Butzengeiger, Sonja (2004) Clean Development Mechanism and Joint Implementation: New Instruments for Financing Renewable Energy Technologies, Thematic Background Paper Renewables 2004, Bonn, download at: http://www.renewables2004.de/pdf/tbp/TBP06-CDM-JI.pdf (March 6th, 2005).

Michaelowa, Axel; Butzengeiger, Sonja; Bode, Sven (2003a) Bestimmung von Referenzfall und Zusätzlichkeit bei CDM-Projekten - Worauf müssen Unternehmen achten?, Umwelt-Wirtschafts-Forum, 11 (3), September 2003.

Michaelowa, Axel; Jotzo, Frank (2003) Transaction costs, institutional rigidities and the size of the Clean Development Mechanism, in: Energy Policy, 33 (4), pp. 511-523.

Michaelowa, Axel (2003a) Structures of DNAs and sustainability criteria worldwide, Presentation at workshop 'Consultation about DNA structure and sustainability criteria', KLH, Jakarta, September 17th, 2003.

Michaelowa, Axel (2003) CDM host country institution building, in: Mitigation and Adaptation Strategies for Global Change, 8, p. 201-220.

Michaelowa, Axel; Stronzik, Markus; Eckermann, F.; Hunt, A. (2003) Transaction costs of the Kyoto Mechanisms, in: Climate Policy, 3 (3), p. 261-278.

Michaelowa, Axel (2001) Rio, Kyoto, Marrakesh – ground rules for the global climate policy regime, HWWA Discussion Paper No. 152, Hamburg.

Müller-Pelzer, Felicia (2004) Der Clean Development Mechanism, HWWA Report No. 244, Hamburg.

OECD (2005) Country risk classification of the participants to the arrangement as of 21st January 2005, Organisation for Economic Cooperation and Development, download at: http://www.oecd.org/dataecd/47/29/3782900.pdf (March 29th, 2005).

Oberthür, Sebastian; Ott, Hermann (1999) Das Kyoto-Protokoll - Internationale Klimapolitik für das 21. Jahrhundert, Sebastian Oberthür, Hermann E. Ott, ISBN 3-8100-2966-1, Springer Verlag, Berlin.

Point Carbon (2005a) Carbon Market Insights – Conference presentations by Vrolijk, Christian; Pluzhnikov/Maximov; Grozeva, I.; Veremiychyck, H., Amsterdam/Oslo.

Point Carbon (2005) Yearly contracted volumes of the Projects in Point Carbon Data Base, December 2004. Personal communication with Point Carbon Experts, May 2005.

Rosenbauer, Georg (2005) Anreize aus dem EU ETS für den Sektor Stromerzeugung, Siemens Power Generation Präsentation Arbeitsgruppe Emissionshandel, UAG 1/2, 22. February 2005, Berlin.

Schlup, Michael (2005) Personal communication with Michael Schlup, Director CDM - Gold Standard, WWF, Basel, April 11th and May 13th, 2005.

Schmidtke, Carsten (2004) Entscheidungstheorie, Internetkompendium, download at: http://www.entscheidungstheorie.net, (May 16th, 2005).

Simonis, Udo E. (2003) Klimawandel – eine weltweite Gefährdung, in: Information zur politischen Bildung, Heft 274, Bundeszentrale für politische Bildung, download at: www.bpb.de (December 5th, 2004).

Sterk, Wolfgang; Bunse, Maike (2004) Voluntary compensation of greenhouse gas emissions; Policy Paper No. 3/2004, Wuppertal Institute for Climate, Environment and Energy, Wuppertal, October 2004.

Sterk, Wolfgang; Langrock, Thomas (2003) Der Gold Standard – Kriterien für CDM- und JI-Projekte, Policy Paper No. 3/2004, Wuppertal Institute for Climate, Environment and Energy, Wuppertal, September 2003.

Sweeney, Paul; Hervig, Donovan (2004) History lessons 1979 - 2004 Country Credit Ratings by Institutional Investor, Sept. 2004, 38 (9), 11 p., ISSN 0020-3580.

Swiss Re (2003) Swiss Re implements ten-year programme to become fully greenhouse neutral: a combination of reducing in-house emissions and co-operating with the World Bank, press release October 30th, 2003; down-load at: http://www.swissre.com/INTERNET/ pwswpspr.nsf/fmBookMark FrameSet?ReadForm&BM=../vwAllbyIDKeyLu/sstk-5srlha?OpenDocument (May 3rd, 2005).

Tangen, Kristian (2005) CDM and JI market volumes 2001-2004, information provided on the basis of Point Carbon's project data base; personal communication with Kristian Tangen, CEO Point Carbon, April 11th, 2005.

Tietenberg, Tom (1985) Emissions trading – an exercise in reforming pollution policy, Resources for the future, Washington, USA.

UBA (2004) Globaler Klimawandel, Klimaschutz 2004, Informationszentrum Um-welt, Umweltbundesamt Mai 2004, Berlin, download at: www.umweltbundesamt.de (April 9th, 2005).

UNFCCC (2005c) Appendix B of the simplified modalities and procedures for small-scale CDM project activities, Type I – Renewable Energy Projects, Version 05: February 2005, download at: http://cdm.unfccc.int/UserManagement/FileStorage/ssc_i_c.pdf (April 18th, 2005).

UNFCCC (2005b) "CDM project activity cycle", Information of the UNFCCC-Secretariat on CDM procedures and requirements, download at: http://cdm.unfccc.int/Projects/pac/index.html (April 22nd 2005).

UNFCCC (2005a) Designated National Authorities (DNA), United Nations Framework Convention on Climate Change, download at: http://cdm.unfccc.int/DNA (29th March, 2005).

UNFCCC (2005) Kyoto Protocol Status of Ratification, Last modified on: 23rd March 2005, United Nations Framework Convention on Climate Change, download at: http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf (March 29th, 2005).

UNFCCC (2004a) Information on national greenhouse gas inventory data from Parties included in Annex I to the Convention for the period 1990–2002, including the status of reporting. Executive summary, UNFCCC, background information (FCCC/CP/2004/5) for the 10th Conference of the Parties, October 14th, 2004; download at: http://unfccc.int/resource/docs/cop10/05.pdf (March 29th, 2005).

UNFCCC (2004) Tool for the demonstration and assessment of additionality, Annex 1 of the Report of the 16th meeting of the Executive Board (EB 16), October 2004.

UNFCCC (2003a) Clarifications on issues relating to baseline and monitoring methodologies, Report of the eighth meeting of the Executive Board, Annex I, March 2003.

UNFCCC (2003) Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories; Report of the seventh meeting of the CDM Executive Board; Annex 6, Appendix B1 of the simplified modalities and procedures for small-scale CDM project activities, March 2003.

UNFCCC (2002) Further clarifications on definitions of eligible activities, Simplified modalities and procedures for small-scale clean development mechanism project activities, FCCC (CP/2002/7/Add.3), p. 18.

UNFCCC (1999) The Kyoto Protocol to the United Nations Framework Convention on Climate Change, UNFCCC/Germany.

Van Bodegom, A.J.; Svenije, H.J.F.; van Tol, G. (2000) The challenge of including forests as sinks within the clean development mechanism, Theme Studies Series 4, International Agricultural Centre (IAC), National Reference Centre for Nature Management (EC-LNV), Wageningen/Netherlands, June 2000.

Von Ruffer, Albrecht (2004) Overview of GHG-Market prices, Power Point Presentation, Natsource Tullep, Hamburg/London, 12th May 2004.

Wandscher, Annika (2004) Klimabewusst zur Renewables2004 und mehr. Planungen des Bundesumweltministeriums; Workshop Clean Business Travel; February 2004, Bonn; download at: www.germanwatch.org (March 21st, 2005).

WBGU (1995) Szenario zur Ableitung globaler CO_2-Reduktionsziele und Umsetzungsstrategien – Stellungnahme zur ersten Vertragsstaatenkonferenz der Klimarahmenkonvention in Berlin, Wissenschaftlicher Beirat Globale Umweltänderungen, Bremerhaven, March 1995.

WBGU (1997) Ziele für den Klimaschutz 1997 – Stellungnahme zur dritten Vertragsstaatenkonferenz der Klimarahmenkonvention in Kyoto, Wissenschaftlicher Beirat Globale Umweltänderungen, Bremerhaven, September 1997.

WBGU (2003) Über Kioto hinaus denken – Klimaschutzstrategien für das 21. Jahrhundert, Berlin, November 2003.

WFAU (2003) Verfahren der biologische Abfallbehandlung; Thomas Kerkhoff, Achim Schmiemann, Kurt Bollwien; Weiterbildender Fernstudiengang Angewandte Umweltwissenschaften, Universität Koblenz-Landau, Studienbrief Kurs Abfallwirtschaft, Koblenz.

Wolf, Roger (2004a) Personal communication with Roger Wolf, Environmental Protection Department of GTZ/Stellvertretender Umweltschutzbeauftragter der Deutschen Gesellschaft für technische Zusammenarbeit.

Wolf, Roger (2004) GTZ-CO_2-Neutral, Presentation at workshop Clean Business Travel, 10th February 2004.

WWF/Greenpeace (2000) The clearcut case: how the Kyoto Protocol could become a driver for deforestation, Tim Cadman, Native Forest Network, Report for Greenpeace International and WWF, USA.

WWF (2002) The Gold Standard – Quality Standards for CDM and JI projects, Final Draft for Consultation, December 2002.

WWF (2003) The Gold Standard – Background and Overview, WWF-Information, July 2003.

Zapfel, Peter (2001) The Commission Proposal for EU-wide Greenhouse Gas Emissions Trading, European Commission/Climate Change Unit, e5 and EMA meeting Hamburg, December 17th, 2001.

The **Hamburgisches WeltWirtschaftsInstitut (HWWI)** is an independent economic research institute, based on a non-profit public-private partnership, which was founded in 2005. The University of Hamburg and the Hamburg Chamber of Commerce are shareholders in the Institute .

The HWWI's main goals are to:

- Promote economic sciences in research and teaching;
- Conduct high-quality economic research;
- Transfer and disseminate economic knowledge to policy makers, stakeholders and the general public.

The HWWI carries out interdisciplinary research activities in the context of the following research programmes: Economic Trends and Hamburg, International Trade and Development, Migration Research and International Climate Policy.

Hamburg Institute of International Economics (HWWI)

Neuer Jungfernstieg 21 | 20354 Hamburg | Germany
Tel +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 76
info@hwwi.org | www.hwwi.org