

Krey, Matthias

Research Report

Transaction costs of CDM projects in India: An empirical survey

HWWA-Report, No. 238

Provided in Cooperation with:

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)

Suggested Citation: Krey, Matthias (2004) : Transaction costs of CDM projects in India: An empirical survey, HWWA-Report, No. 238, Hamburg Institute of International Economics (HWWA), Hamburg

This Version is available at:

<https://hdl.handle.net/10419/32919>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Transaction Costs of CDM Projects in India – An Empirical Survey

Matthias Krey

HWWA-Report

238

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)
Hamburg Institute of International Economics

2004

ISSN 0179-2253

The HWWA is a member of:

- Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (WGL)
- Arbeitsgemeinschaft deutscher wirtschaftswissenschaftlicher Forschungsinstitute (ARGE)
- Association d'Instituts Européens de Conjoncture Economique (AIECE)

Transaction Costs of CDM Projects in India – An Empirical Survey

Matthias Krey

A major part of the insights concerning Indian CDM development was collected during a CDM capacity building programme on behalf of GTZ.

This paper was prepared while Matthias Krey was an Intern within the HWWA-Programme International Climate Policy.

Edited by the Department World Economy
Head: PD Dr. Carsten Hefeker

HWWA REPORT

Editorial Board:

Prof. Dr. Thomas Straubhaar

PD Dr. Carsten Hefeker

Dr. Konrad Lammers

Dr. Otto G. Mayer

Dr. Eckhardt Wohlers

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)

Hamburg Institute of International Economics

Öffentlichkeitsarbeit

Neuer Jungfernstieg 21 • 20347 Hamburg

Telefon: 040/428 34 355

Telefax: 040/428 34 451

e-mail: hwwa@hwwa.de

Internet: <http://www.hwwa.de/>

Matthias Krey

Schützenstraße 24

22761 Hamburg

Telefon: 040/854 18 940

e-mail: mootias@gmx.de

Executive Summary

Transaction costs of CDM projects consist of the cost components search costs, negotiation costs, PDD costs, approval costs, validation costs, registration costs, monitoring costs, verification and certification costs and costs accruing from the adaptation fee.

During an empirical survey the author quantified transaction costs of 15 unilateral potential CDM projects in India. For each project at least 4 components could not be quantified. Aggregated over all projects for which data was available specific transaction costs range from 0.06 – 0.47 \$US/t CO₂. This is approximately 76% to 88% of total transaction costs of the projects.

The specific abatement costs are mainly determined by a project's total emission reduction. For all cost components apart from the costs accruing from the adaptation fee a significant cost depression with rising emission reductions was observed.

The dominant share in total specific transaction costs for projects with high emission reductions have the costs accruing from the adaptation fee (68%) which depend on a project's emission reduction and the CER price.

For projects with low emission reductions the major components are PDD costs (27%), search costs (19%), costs arising from the adaptation fee (19%) and validation costs (17%). PDD costs and validation costs depend on the projects' complexity. Search costs depend on the requirements of the buyer.

For 7 projects total specific transaction costs have been estimated. They range from 0.07 – 0.47 \$US/t CO₂. Abatement costs could not be obtained for any of the projects. However, it can be assumed that a number of the renewable energy projects (5 projects) are viable when considering typical abatement costs of 1 – 4 \$US/t CO₂ for renewable energy projects in India and the current CER prices paid (3.15 – 6.50 \$US/t CO₂).

In the short-term no considerable reductions in transaction costs of CDM projects in India can be expected.

Contents

Executive Summary	I
Contents	II
List of Figures	III
List of Tables	IV
Abbreviations	V
1 Introduction.....	1
2 Methodology	4
3 The Clean Development Mechanism (CDM) - From Concept to First Projects	5
3.1 The Evolution of CDM in International Climate Policy.....	5
3.2 CDM Rules in Detail	9
3.3 Economic and Institutional Principles of CDM.....	17
3.4 The CER Market.....	23
4 Transaction Costs of CDM Projects	30
4.1 Transaction Costs in Neo-Institutional Economics.....	30
4.2 The Role of Transaction Costs in Environmental Externalities	33
4.3 Transaction Costs of CDM Projects	34
4.4 Transaction Cost Components of CDM Projects.....	37
4.5 First Estimates for Transaction Costs of CDM Projects.....	51
4.6 Summary of Transaction Costs of CDM Projects	57
4.7 Implications for Empirical Research Design	60
5 A Survey Among Players in CDM in India	63
5.1 Information on CDM Potential and CDM Development in India	63
5.2 Aim of and Strategy for the Survey	65
5.3 Participants in the Survey and Major Questions in the Interviews.....	66
5.4 Brief Critique of the Interviews	66
6 Current Situation of CDM Project Development in India	68
6.1 Current Status	68
6.2 Current Trends	71
7 Transaction Costs of Potential CDM Projects in India.....	74
7.1 Strategy for Quantification of Transaction Costs	74
7.2 Results from the Quantification.....	75
7.3 Critical Appraisal of Results Quantified.....	78
7.4 Assessment of the Results.....	79
7.5 First Discussion of Future Development of Transaction Costs	94
8 Summary and Scope for Further Research	97
Appendix.....	100
References.....	113

List of Figures

Figure 1: The Principle of a Baseline	10
Figure 2: The CDM Project Cycle.....	16
Figure 3: Institutional Project Design Options for CDM Projects.....	23
Figure 4: Share in Total Volume of CERs of Selected Potential CDM Projects by Host Country.....	26
Figure 5: Share in Total Volume of CERs of Selected Potential CDM Projects by Project Type.....	27
Figure 6: Supply and Demand in the Presence of Transaction Costs.....	32
Figure 7: The Impact of Transaction Costs on the Use of the CDM	36
Figure 8: Share in Total Anticipated Volume of CERs of Selected Potential CDM Projects in India by Project Type.....	70
Figure 9: Major Players in CDM in India.....	73

List of Tables

Table 1: Options for Participation in CDM	19
Table 2: Global Distribution of CER Supply from Non-Sink CDM Projects in the First Commitment Period	29
Table 3: Market Transaction Cost Categories	32
Table 4: Transaction Cost Groups of CDM Projects and Their Cost Components	38
Table 5: Registration Fee for CDM Projects	48
Table 6: Estimates for Absolute Transaction Costs of Potential Non-SSC CDM Projects by Cost Component	54
Table 7: Dependence of Specific Transaction Costs of CDM Projects on the Total Emission Reduction.....	55
Table 8: Absolute Transaction Costs and Their Dependence on Selected Factors	59
Table 9: Potential Sources of Information for Transaction Costs of CDM Projects	62
Table 10: CO ₂ Mitigation Potential in the Indian Energy Sector from 2002 to 2012	64
Table 11: Overview on Potential CDM Projects in India	69
Table 12: Anticipated Average Emission Reductions of Selected Potential CDM Projects in India by Project Type	71
Table 13: Data Availability and Range of Transaction Costs of Selected Potential CDM Projects in India	76
Table 14: Shares of Transaction Costs Quantified in Total Transaction Costs of Selected CDM Projects in India	81
Table 15: Dependence of Specific Transaction Costs of Selected CDM Projects in India on the Total Emission Reduction of the Project.....	83
Table 16: Shares of Cost Components in Specific Transaction Costs Quantified for CDM Projects in India.....	84
Table 17: Selected CDM Projects in India and Their Belonging to Project Groups with Different Degree of Project Complexity.....	86
Table 18: Validation Costs and Project Complexity of Selected Potential CDM Projects in India	88
Table 19: Absolute Total Transaction Costs of Selected CDM Projects in India	90
Table 20: Total Specific Transaction Costs of Selected CDM Projects in India and Their Impact on the Projects' Viability	93
Table 21: Search Strategy of Buyers and Required Documentation	94

Abbreviations

\$US	US Dollar
£	British Pound
€	Euro
a	Year
AAU(s)	Assigned Amount Unit(s)
AIJ	Activities Implemented Jointly
Art.	Article
Av.	Average
BAU	Business-as-usual
BCF	Bio Carbon Fund
BP	Beyond Petroleum
CDCF	Community Development Carbon Fund
CDM	Clean Development Mechanism
CER(s)	Certified Emission Reduction(s)
CERUPT	Certified Emission Reduction Unit Procurement Tender
CO ₂ (e)	Carbon Dioxide (equivalent)
Comp.	Company
COP	Conference of the Parties
DA	Development Alternatives
DNA	Designated National Authority
OE	Designated Operational Entity
DPA	Direct Purchase Agreement
E&Y	Ernst&Young
EB	Executive Board
EC	European Commission
EIA	Environmental Impact Assessment
EID	Environmental Impact Documentation
ER	Emission Reduction
ERPA	Emission Reduction Purchase Agreement
ERU(s)	Emission Reduction Unit(s)
EU	European Union
EU-ETS	Emissions Trading Scheme of the European Union
G	Giga
GHG(s)	Greenhouse Gas(es)
GoF	Government of Finland
GoI	Government of India
GoN	Government of the Netherlands
Gov.	Government
GWh	Gigawatt hour
IDFC	Infrastructure Development Finance Company
IET	International Emissions Trading
INC	Intergovernmental Negotiation Committee
ITCs	Implementation Transaction Costs
JI	Joint Implementation
k	Kilo

kWh	Kilowatt hour
L&B	Louis&Berger
LoE	Letter of Endorsement
LoI	Letter of Intent
LPG	Liquified Petroleum Gas
max.	Maximum
min.	Minimum
MoEF	Ministry of Environment and Forests, Government of India
MSW	Municipal Solid Waste
Mt	Million tonnes
MTACs	Market Transaction Costs
MW	Megawatt
n.a.	Not available
NCDF	Netherlands Clean Development Facility
NGO	Non-Governmental Organisation
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
PCF	Prototype Carbon Fund
PCN	Project Concept Note
PDD	Project Design Document
PIN	Project Idea Note
PITCs	Pre-implementation Transaction Costs
pot.	Potential
PV	Photovoltaics
PWC	PriceWaterhouseCoopers
s.a.	See above
SEID	Social and Environmental Impact Documentation
SME	Small- and Medium Sized Enterprise
SSC	Small-scale
t	Tonne
TACs	Transaction Costs
TERI	The Energy and Resources Institute
ToR	Terms of Reference
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
V	Volt
V+C	Verification and Certification
VER(s)	Verified Emission Reduction(s)
WII	Winrock International India

1 Introduction

The scientific evidence mounts that the anthropogenic emissions of the so called greenhouse gases (GHGs)¹ lead to a potentially threatening change of the global climate system for mankind (see Albritton et al. 2001). In the Kyoto Protocol (1997) the developed countries (Annex B countries) committed themselves to reduce their GHG emissions by 5.2% in the period from 2008 to 2012 on the basis of the emission levels in 1990 by formulating binding emission targets for each country.

Besides Joint Implementation and Emissions Trading CDM is the third of the “Kyoto Mechanisms” defined in the Kyoto Protocol that allow the developed countries to meet their GHG targets in a cost-effective manner. The CDM provides for the transfer of Certified Emission Reductions (CERs) from potentially low-cost GHG mitigation projects in developing countries (Non-Annex I countries) to the Annex B countries under internationally agreed rules. Annex B countries can use CERs for compliance with their emission targets. Such projects are called CDM projects once they are registered by the Executive Board (EB) of the CDM.

CDM projects are associated with transaction costs that hamper the cost-effectiveness of the CDM (Michaelowa/Stronzik 2002, p. 7f.). Estimates of the magnitude of transaction costs of CDM projects exist but empirical evidence is very scarce (see Fichtner et al. 2003, p. 259).

India is perceived to be among the most attractive Non-Annex I countries for CDM project development (see Buen 2002, p. 3f; see Point Carbon 2003a). Reasons are the large GHG reduction potential and the relatively strong capacity of Indian private companies in both GHG mitigation technology and understanding of the CDM rules (see TERI 2001, p. 12ff; see Buen 2002, p. 4).

¹ Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and the halons. The so called indirect GHGs are the reactive gases carbon monoxide (CO), volatile organic compounds (VOC) and nitrogen oxides NO_x (see Albritton et al. 2001).

It is the objective of this study to empirically quantify transaction costs of potential CDM projects in India and to conduct a preliminary assessment of the results found. Potential sink CDM projects² are not within the scope of this study.

The study is structured into 8 main chapters.

The following chapter 2 describes the methodology applied to empirically quantify transaction costs of CDM projects in India.

Chapter 3 outlines the evolution of the CDM in international climate change policy, the current state of the Kyoto Mechanisms and the rules for CDM. Additionally, it describes the economic and institutional principles of CDM and the market for CERs.

Chapter 4 sets out with a general definition of transaction costs. Afterwards, the definition of transaction costs of CDM projects used in this study is presented and the impact of transaction costs on the use of the CDM illustrated. Subsequently, from the definition of transaction costs of CDM projects transaction cost components are derived and it is discussed on which factors they might depend on. Subsequently, preliminary estimations of the magnitude of transaction costs are presented and their potential implications on the viability of CDM projects are discussed. Finally, the chapter is summarised and a survey among the parties involved in CDM project development identified to be an appropriate means for quantification of transaction costs.

Chapter 5 outlines the aim and strategy of the empirical survey conducted among CDM experts in India in order to quantify transaction costs of these projects in India. It also presents the participants in the survey.

Chapter 6 presents the findings on the current situation of CDM project development in India.

Chapter 7 briefly describes the projects for which transaction costs could be quantified during the survey and outlines the strategy used for quantification of these costs. Subsequently, the results are presented, the uncertainties involved in the results are

² The internationally agreed rules for the CDM distinguish between sink projects and other CDM projects (see UNFCCC 2001, 17/CP.7, para 11). Generally, a sink is defined as “*any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere*” (UNFCCC 1992, p. 5). Forestry projects are the only sinks eligible for the CDM (see Jung 2003, p. 1).

highlighted and a preliminary assessment of the results is carried out. Finally, a first discussion of the possible future development of transaction costs of CDM projects in India is undertaken.

Chapter 8 summarises the main findings of this study and indicates potential areas for further research.

2 Methodology

Methodologically this study is split into two parts.

The first part is concerned with the definition of transaction costs of CDM projects and their cost components in general. The methodological approach to define these costs and their different components builds on the review of relevant literature on this subject as well as on information on institutional design options for CDM projects and developments in the current CER market. The definition partly integrates the concept of transaction costs as defined in neo-institutional economics.

The second part deals with the methodology used for quantification of transaction costs of CDM projects in India. For this purpose a survey among the parties involved in CDM projects in India was conducted from April to August 2003. This survey consisted of a series of personal interviews in India and the exchange of electronic questionnaires. Quantification was carried out on a project-specific basis. The participants were asked to directly quantify parts of transaction cost components for specific projects they were involved in.

The participants quantified transaction costs in \$US. Cost estimates from literature quoted in this study either came in € or £. In this study these cost figures are transferred into \$US with the following conversion rates (see Yahoo 2003):

- 1 € = 1.1775 \$US
- 1 £ = 1.6952 \$US.

Some transaction cost components needed to be quantified by the author with other information than costs given by the participants. In these cases the approach for quantification is explained at the appropriate stage of this study.

3 The Clean Development Mechanism (CDM) - From Concept to First Projects

This chapter is structured as follows. First, section 3.1 gives a brief overview of how CDM emerged in international climate policy as well as on its present state. Subsequently, section 3.2 describes the rules of CDM. Afterwards, section 3.3 outlines the economic and institutional principles. Finally, section 3.4 describes the emerging market for CERs.

3.1 The Evolution of CDM in International Climate Policy

This section outlines how the concept of joint implementation (JI), the forerunner of CDM, was introduced into international climate policy (3.1.1) and a “pilot phase” for activities implemented jointly (AIJ) was established (3.1.2). Subsequently, the major decisions of the Kyoto Protocol (1997) on the Kyoto Mechanisms are outlined (3.1.3). Finally, the most important decisions of the Marrakech Accords (2001) are presented and its implications on the present state of the international climate policy regime and CDM are highlighted (3.1.4).

3.1.1 The United Nations Framework Convention on Climate Change (UNFCCC) and the Concept of Joint Implementation (JI)

In 1992, at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro the United Nations Framework Convention on Climate Change (UNFCCC) was signed by 154 nations. Its ultimate objective is to achieve “*the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*” (see UNFCCC 1992, Art. 2). Even though the UNFCCC does not contain specified GHG emission targets it is legally binding. It lays down the fundamental goals and principles to which the signatories must adhere. The Parties to the Convention decided to negotiate the specific obligations of the Parties in subsequent years at so called Conferences of the Parties (COPs).

Article 4.2 of the UNFCCC lays the conceptual basis for what has been defined as CDM in 1997. However, in 1992, the concept was named “Joint Implementation” (JI) and was only roughly outlined in Article 4.2(a) of the UNFCCC. The article says that Parties to the Convention that are industrialised countries and other Parties incorporated

in Annex I³ are allowed to implement measures for limiting GHG emissions and for conserving reservoirs and sinks “*jointly with other parties*” (ibid, Art 4 para 2(a)).

The main rationale for JI was the potential for a cost-effective realisation of the ultimate objective of the UNFCCC as demanded in Article 3 of the Convention (see ibid, Art 3). Given the variation in abatement costs from country to country⁴ it would be more cost-effective for a country with high marginal abatement costs to invest in a GHG mitigation project in a country with lower marginal abatement costs in order to reduce GHG emissions (see Pearce 1994, p. 15). The JI concept as discussed among climate policy experts foresaw that the investor country would receive credits for the emission reductions achieved in the country abroad (host country) that could be used to meet possible future GHG targets (see ibid, p. 15). Criteria for JI should be decided upon at the first Conference of the Parties (COP1).

3.1.2 *The Implementation of a Pilot Phase for Activities Implemented Jointly (AIJ)*

In the period leading to COP1 in Berlin in 1995 the Intergovernmental Negotiating Committee (INC)⁵ attempted to decide on criteria and fundamental rules for JI. Due to the diverging interests of the Parties final agreement could not be reached⁶. The committee agreed on a loose set of criteria and recommended the introduction of a pilot phase for JI to COP1 (see INC 1995, p. 23ff.). Upon this recommendation COP1 decided on the introduction of a four-year pilot phase for “Activities Implemented Jointly” (AIJ). It provided for a mechanism based on the concept of JI among all Parties⁷. However, no credits should accrue (see UNFCCC 1995, 18ff.). Deliberately, the Parties left open which type of projects may be chosen and which criteria will apply

³ After highlighting the “*common but differentiated responsibilities*” (UNFCCC 1992, Art. 3.1) the UNFCCC explicitly states that the developed countries should take the lead in combating climate change (see ibid, Art. 3.1). To that end the UNFCCC incorporates two annexes which refer to special obligations under the UNFCCC. Annex I includes all OECD countries and countries in transition from Central and Eastern Europe. Besides other obligations countries in Annex I should aim at reducing their GHG emissions to 1990 emission levels until 2000. By default the other countries are referred to as Non-Annex I countries. Annex II countries are the original 24 OECD countries and the EU. They have the special obligation to assist developing countries in achieving the objective of the UNFCCC with financial and technological resources.

⁴ For example marginal abatement costs for a given absolute emission reduction are estimated to be significantly lower in developing countries than in industrialised countries (see Moomaw et al. 2001, p. 256ff.).

⁵ The INC was established by the UN General Assembly in 1990. Its mandate was to prepare the UNFCCC (see Schröder 2001, p. 19).

⁶ Especially the developing countries heavily opposed JI because they saw it “*as an attempt by the industrialised countries to buy their way out of reduction commitments*” (Michaelowa 2000, p. 16ff.). They demanded that JI should be restricted to Annex I countries.

⁷ By giving JI a different name JI opponents were in the position to argue that they “*had not given in to industrialised country interests*” (Trexler/Kosloff 1998, p. 4).

to AIJ projects. They wanted to gain experience and decide about JI at the end of the pilot phase (see Trexler/Kosloff 1998, p. 4ff.).

3.1.3 *The Kyoto Protocol and the Kyoto Mechanisms*

In the Kyoto Protocol that was adopted at COP3 in Kyoto in 1997 the Annex B countries⁸ took on legally binding emission targets. They committed themselves to reduce a basket of six GHGs⁹ by in total 5.2% in the period from 2008 to 2012 (first commitment period) compared to emission levels in 1990¹⁰. The Non-Annex I countries as well as Turkey and Belarus have not taken on any targets. The Kyoto Protocol will come into force once 55 states which at least have to represent 55% of Annex I country emissions from 1990 have ratified it. It allows for three distinct flexibility measures commonly referred to as the “Kyoto Mechanisms”¹¹ for meeting the targets¹²: international emissions trading, joint implementation¹³ and the clean development mechanism.

International Emissions Trading (IET) is defined in Art. 17 and allows Annex B countries to trade their Assigned Amount Units (AAUs)¹⁴ between them in order to achieve compliance with their targets (see UNFCCC 1997, p. 25).

Joint Implementation (JI) is defined in Art. 6 and provides for the transfer of Emission Reduction Units (ERUs) from GHG mitigation projects from one Annex I country to another (see *ibid*, p. 13f.).

⁸ The term refers to the Annex B of the Kyoto Protocol. It contains 38 OECD countries and countries in transition from Central and Eastern Europe (see UNFCCC 1997, p. 32). It represents the countries of the Annex I of the UNFCCC except for Turkey and Belarus.

⁹ They encompass CO₂, CH₄, N₂O, HFCs, PFCs and SF₆.

¹⁰ The targets are based on the average emissions of all six GHGs weighted by their global warming potential. The reduction targets of each Annex B country can be found in UNFCCC (1997), p. 32.

¹¹ The Kyoto Mechanisms are based on the concept of emissions trading. Its economic rationale is outlined in section 3.3.1.

¹² The Kyoto Protocol also provides for a fourth flexibility measure that is commonly referred to as the “bubble” (see UNFCCC 1997, p. 11f.). It allows Annex B countries to jointly commit to a target. The EU member states have established a bubble. However, “bubbles” do not lie within the scope of this study and are therefore not further considered.

¹³ COP3 allowed credits to accrue against emission targets from two different project types that are based on the JI concept. These project types are distinct from AIJ and are called joint implementation and clean development mechanism. The latter came as a “Kyoto Surprise” as the developing countries until the last night of the negotiations opposed the concept of JI in developing countries. However, compromise between the positions of the USA and Brazil under mediation of Costa Rica led to the acceptance of JI in developing countries under the synonym of CDM (see Michaelowa 2000, p. 27). To make this point clear: The concept of JI in the pre-Kyoto period led to the implementation of the AIJ pilot phase. AIJ was JI with loose criteria and without crediting. Surprisingly, before the AIJ pilot phase was completed the JI concept re-emerged in Kyoto in the form of joint implementation and the clean development mechanism.

¹⁴ In the Kyoto Protocol, the 5-year emission budget of each commitment period is termed Assigned Amount. Assigned Amount Units (AAUs) are the tradable parts of this budget (see Janssen 2001, p. 24ff.).

The Clean Development Mechanism (CDM) is defined in Art. 12 and provides for the transfer of Certified Emission Reductions (CERs) from GHG mitigation projects in Non-Annex I countries to Annex I countries (see *ibid*, p.19ff.).

Annex B countries can use AAUs, ERUs and CERs¹⁵ for compliance in the first commitment period¹⁶.

The Kyoto Mechanisms have not been worked out in detail at COP3 and it was up to future climate negotiations to work out the rules and operational details.

3.1.4 The Marrakech Accords - Present State of the International Climate Policy Regime and CDM

After problems of finding consensus on crucial issues contained in the Kyoto Protocol final agreement could be reached at COP7 in Marrakech in 2001. The decisions taken by COP7 are known as the Marrakech Accords. They shaped the final design of the international climate policy regime and paved the way for ratification of the Kyoto Protocol (see Michaelowa 2001a, p. 1). Apart from the U.S. and Australia all industrialised countries have stated that they will ratify the Kyoto Protocol (see *ibid*, p. 1). The entering into force of the Kyoto Protocol depends on the ratification of Russia which is pending. Without it the imperative threshold of 55% of the Annex I countries GHG emissions in 1990 cannot be reached.

Concerning CDM the following general decisions have been made. The CDM fulfills two purposes (see UNFCCC 2001, 17/CP.7). First, to assist Non-Annex I countries in achieving sustainable development. Second, to assist Annex B countries in achieving their emission targets.

No thresholds apply to its use¹⁷ and nuclear projects are de facto excluded¹⁸ (see Jotzo/Michaelowa 2002, p. 180). CDM projects need to be approved from the host country and emission reductions of CDM projects need to be additional to those that would have occurred in the absence of the project¹⁹ (see UNFCCC 2001, -/CMP.1 (Article 12)). CERs may be generated from CDM projects starting as of the year 2000 and banked for use in future commitment periods (see *ibid*, -/CMP.1 (Article 12)).

¹⁵ A CER is equal to one metric tonne of CO₂-equivalent. So are AAUs and ERUs (see UNFCCC 2001, -/CMP.1 (Article 17), Annex, para 1).

¹⁶ They may also be banked for use in possible future commitment periods (see Michaelowa 2001a, p. 26).

¹⁷ An Annex B party is allowed to use the Kyoto Mechanisms “*supplemental*” to domestic action (UNFCCC 2001, 15/CP.7). However, “*supplemental*” is not further defined.

¹⁸ The COP recognises that the parties should “*refrain*” from using ERUs and CERs that are generated from nuclear facilities (UNFCCC 2001, 17/CP.7 and 16/CP.7)

¹⁹ This criteria will be discussed in detail in section 3.2.2.

COP7 laid down detailed rules for CDM which allowed it to officially start (see *ibid*, 17/CP.7, para 1). It was also decided that 2% of the share of the CERs generated by any CDM project should be transferred into an adaptation fund which would be used for partly compensating the countries that are particularly vulnerable to adverse effects of climate change for their adaptation costs (see *ibid*, 17/CP.7, para 15 (a)). The COP also elected an executive board for CDM (EB) that should “*supervise the CDM*” (*ibid*, 17/CP.7, para 5). The EB has a central role in the CDM as it is responsible for the official registration of the projects. Only upon registration a project is eligible to generate CERs.

3.2 CDM Rules in Detail

This section explains the rules of the CDM in detail. For this purpose it is structured as follows. First, the requirements for countries that want to take part in CDM are presented (3.2.1). Afterwards, the concept of additionality as a major requirement for a projects’ eligibility under CDM is outlined (3.2.2). Subsequently, the procedure is described that project developers have to follow in order to generate CERs from their GHG mitigation projects²⁰ (3.2.3). Finally, the latest developments with regard to the registration of CDM projects are presented (3.2.4).

3.2.1 *Participation Requirements*

Participation in CDM is voluntary and countries willing to participate are required to designate a national authority for the CDM (see *ibid*, -/CMP.1 (Article 12), Annex, para 29). Its role is illustrated in section 3.2.3. Non-Annex I countries can only participate in CDM if they have ratified the Kyoto Protocol and Annex B countries can only credit CERs if they have ratified the Kyoto Protocol and comply with specific methodological and reporting requirements which are not further considered here (see UNFCCC 2001, -/CMP.1 (Article 12), Annex, para 28-31).

3.2.2 *The Baseline Concept and Additionality of CDM Projects*

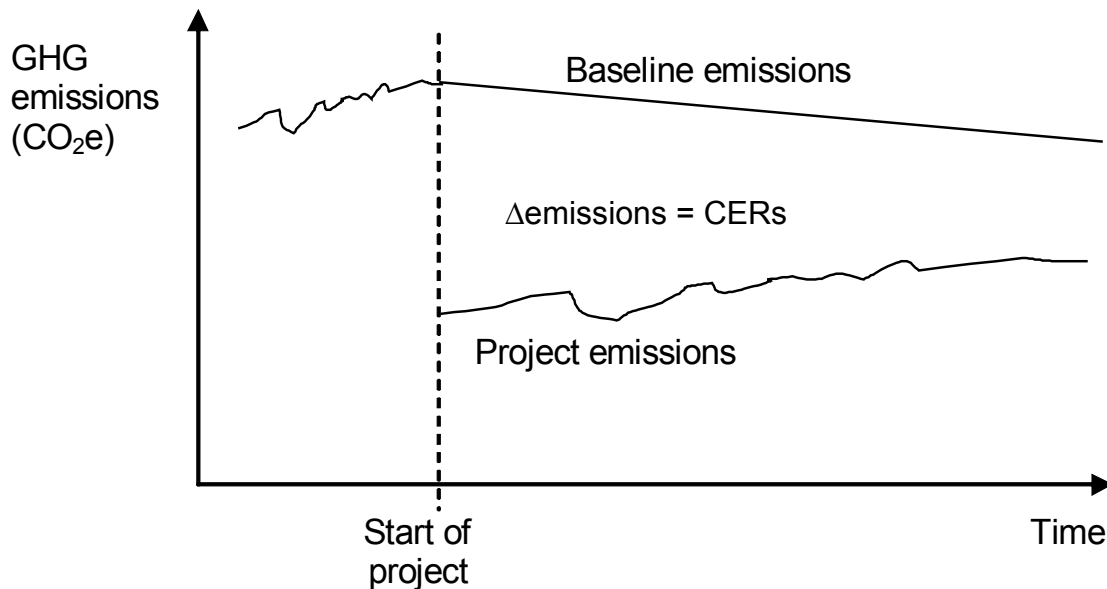
The overarching requirement for GHG mitigation projects to be eligible under the CDM is that the GHG emission reductions for which CERs are generated are “additional”. In the following the concept of additionality is explained.

The amount of CERs generated by a CDM project over a given period is calculated by subtracting the actual project emissions during project operation from the so called GHG “baseline” emissions (see Janssen 2001, p. 87). A “baseline” is a counterfactual

²⁰ In this context a project developer is an entity that is responsible for the development of the project.

scenario for the level of emissions without the proposed project²¹ (see Michaelowa/Schmitz 2003, p. 5). The concept is illustrated in figure 1.

Figure 1: The Principle of a Baseline



Source: following Michaelowa/Schmitz (2003), p. 5

In general a baseline may be expressed in absolute emission levels or in emission factors (e.g. g CO₂/kWh) (Janssen 2001, p. 90). Project emissions are usually calculated by multiplying the activity level of the project with a corresponding emissions factor (see Janssen 2001, p. 92). Several approaches for baseline determination have been proposed²². The CDM rules require that a baseline has to be established on a project-specific basis (see UNFCCC 2001, -/CMP.1 (Article 12), Annex, para 45 (c)). Project specific baselines are usually “drawn up by using project specific assumptions, measurements, comparisons, estimates or simulations for all key parameters” (Janssen 2001, p. 89).

According to the CDM rules the baseline is expected to take into account national legislation and the economic situation in the sector the project is realised in (see UNFCCC 2001, -/CMP.1 (Article 12), Annex, para 45 (e)). It is also expected to rest on

²¹ The CDM rules state that a baseline is “the scenario that reasonably represents the [...GHG emissions...] that would occur in the absence of the proposed project activity” (see UNFCCC 2001, -/CMP.1 (Article 12), Annex, para 44).

²² See *inter alia* Ellis/Bosi (1999), Kartha et al. (2002) and JIN et al. (2003).

a comprehensible methodology. Project developers can choose from three approaches for establishing the baseline methodology (see *ibid*, -/CMP.1 (Article 12), Annex, para 48):

- (a) Current or historical emissions.
- (b) Emissions of an economically attractive investment, taking into account investment barriers.
- (c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technical circumstances and whose performance is among the top 20% of their category.

The baseline of a project and the “additionality” of a potential CDM project are linked. The CDM rules say that a project “*is expected to result in a reduction [...of GHG emissions...] that is additional to any that would occur in the absence of the proposed project activity*” in order to be eligible for the CDM (*ibid*, -/CMP.1 (Article 12), Annex, para 37, (d)) and that a project “*is additional if [...GHG emissions...] are reduced below those that would have occurred in the absence*” of the project (*ibid*, -/CMP.1 (Article 12), Annex, para 43). Hence, it can be concluded that additionality is assessed on the basis of the baseline (see JIN et al. 2003, p. 136).

However, the rules do not give any guidelines on how additionality testing should be integrated in the baseline methodology. It is not within the scope of this study to give a detailed account of the technicalities involved in baseline determination and the debate on the operationalisation of additionality²³.

3.2.3 The Project Cycle for CDM Projects

Before a project can generate CERs a sequence of tasks have to be performed by the project developers, the EB and other CDM institutions. This sequence of tasks that the projects have to pass in a chronological order is commonly referred to as the CDM “project cycle”. It consists of the following stages: Project Design Document (PDD) preparation, host country approval, validation, registration, monitoring, verification and certification and issuance of CERs. The CDM project cycle and involved actors are illustrated in figure 2 at the end of this section.

²³ For an overview of different approaches to incorporate additionality testing in the baseline see JIN et al. (2003).

3.2.3.1 *Project Design Document (PDD) Preparation*

The Project Design Document (PDD)²⁴ requires the project developer to provide the following information to the independent third party²⁵ that undertakes validation (see UNFCCC 2003a):

- 1) Project description including the purpose of the project and a technical description.
- 2) Description of the methodology used for establishing the baseline. No baseline methodologies have been defined by the EB. A project developer willing to obtain a validation needs to establish a new baseline methodology for each new “project category”²⁶ of his project if it is the first of its kind to be validated (see UNFCCC 2001, -/CMP (Article 12), Annex, para 38). In such cases the new baseline methodology needs to be approved by the EB before the project can be validated²⁷. By applying the approved methodology to the project the project developer can finally project his baseline emissions. Once the EB approves a methodology it is made publicly available and can be used by other project developers for projects in the same category.
A baseline is valid for the duration of one “crediting period” (see below).
- 3) Statement which crediting period was selected. The crediting period determines for which period the CDM project will generate CERs when registered. Project developers can either choose a crediting period of ten years with no option of renewal or a crediting period of seven years with two options of renewal as a maximum. At each renewal the baseline needs to be re-validated (see UNFCCC 2001, -/CMP (Article 12), Annex, para 49 (a)).

²⁴ The PDD is a standardised document that is publicly available at the EB website (see UNFCCC 2003a).

²⁵ Independent third parties that perform validation or verification and certification of CDM projects are referred to as Designated Operational Entities (DOEs) by the COP (see UNFCCC 2001, -/CMP (Article 12), Annex, para 27). In order to perform validation or verification and certification they need to be accredited by the EB. Currently, no OE has been officially accredited. In the context of this study they will also be referred to as “validator” or “verifier”.

²⁶ “Project category” refers to the inherent characteristics of the project that will influence the baseline and therefore need to be considered in the methodology. Primarily, the project category will be determined by the project type.

²⁷ The validator is required to submit the new baseline methodology along with a draft PDD to the EB for review (see *ibid*, -/CMP (Article 12), Annex, para 37 (e) (ii)). The approval process should not take longer than four months (see *ibid*, -/CMP (Article 12), Annex, para 37 (e) (ii)).

- 4) Description of the monitoring plan. The project developer needs to give detailed information on how data is collected and archived that is relevant for the calculation of project emissions, emissions outside the project boundary as well as the determination of the baseline. This information needs to be compiled in a monitoring plan. It must also provide for collection and archiving of data relevant for the environmental impact of the project as well as quality assurance and control procedures for the monitoring process. As it is the case with the project baseline, the monitoring plan needs to be derived from a monitoring methodology applied in the context of the project. A new monitoring methodology needs to be approved by the EB.
- 5) Documentation on the analysis of environmental impacts of the project. The PDD requires either a documentation on the analysis of the environmental impacts of the project and, if those are considered significant by the project developer or the host country, the project developer has to carry out an Environmental Impact Assessment (EIA) according to the procedures of the host country (see *ibid*, -/CMP (Article 12), Annex, para 37 (c)).
- 6) Description how stakeholder comments were sought and how “*due account*” was taken of the comments received (*ibid*, -/CMP (Article 12), Annex, appendix B, para 2 (h)). The term “stakeholder” is defined as the “*public, including individuals, groups or communities affected, or likely to be affected*” by the proposed CDM project (see UNFCCC 2001, -/CMP (Article 12), Annex, para 1 (e)).
- 7) Description of calculations used to determine the emission reductions²⁸ achieved by the CDM project.

3.2.3.2 Host Country Approval

Another prerequisite for validation is that the project developer has received written assurance of the host countrys’ designated national authority (DNA) that the host country participates voluntarily and that the proposed CDM project will assist the

²⁸ Here and in the following the term “emission reduction” in the context of CDM projects will be used as a synonym for the amount of emission reductions achieved below the project’s baseline which will determine the CERs eventually generated by the project.

country in achieving sustainable development (see *ibid*, -/CMP (Article 12), Annex, para 40 (a)).

3.2.3.3 Validation

Before the EB registers a CDM project it requires the validator to submit a request for registration in form of a validation report. It states on the basis of the review of the PDD that all requirements for a CDM project as stipulated in the CDM rules are met (e.g. that the project is additional, that the monitoring plan is in accordance with the requirements and that the project developer has received host country approval) (see *ibid*, -/CMP (Article 12), Annex, para 35).

3.2.3.4 Registration

Registration is the official acceptance of the EB of the validated project as a registered CDM project. Registration is the precondition for verification, certification and issuance of the CERs. A project not accepted for registration may be re-submitted after renewed validation (see *ibid*, -/CMP (Article 12), Annex, para 42). COP7 decided that the EB should charge a registration fee as long as the COP has not determined a percentage of CERs issued that should remain at the EB to cover its administrative expenses (see *ibid*, 17/CP.7, para 17). The rates of the registration fee are displayed in section 4.4.2.4.

3.2.3.5 Monitoring

Upon registration the project developer needs to implement the monitoring plan as outlined in the PDD (see *ibid*, -/CMP (Article 12), Annex, para 56). Afterwards, the project will be monitored and the resulting CERs calculated. If the project developer wants the CERs to be verified and certified he submits a monitoring report to the OE that he has contracted for verification and certification (see *ibid*, -/CMP (Article 12), Annex, para 60).

3.2.3.6 Verification and Certification

Verification is the periodic independent review and ex-post determination of the monitored emission reductions, resulting from the CDM project during the verification period²⁹. The OE performing validation is not allowed to be the same OE performing the verification and certification (see UNFCCC 2001, -/CMP (Article 12), Annex, para 27 (e)). The documentation will be submitted to the EB in form of a verification report (see *ibid*, -/CMP (Article 12), Annex, para 62). Certification is the written assurance by the

²⁹ The verification period is the period between each submission of a monitoring report to the verifier.

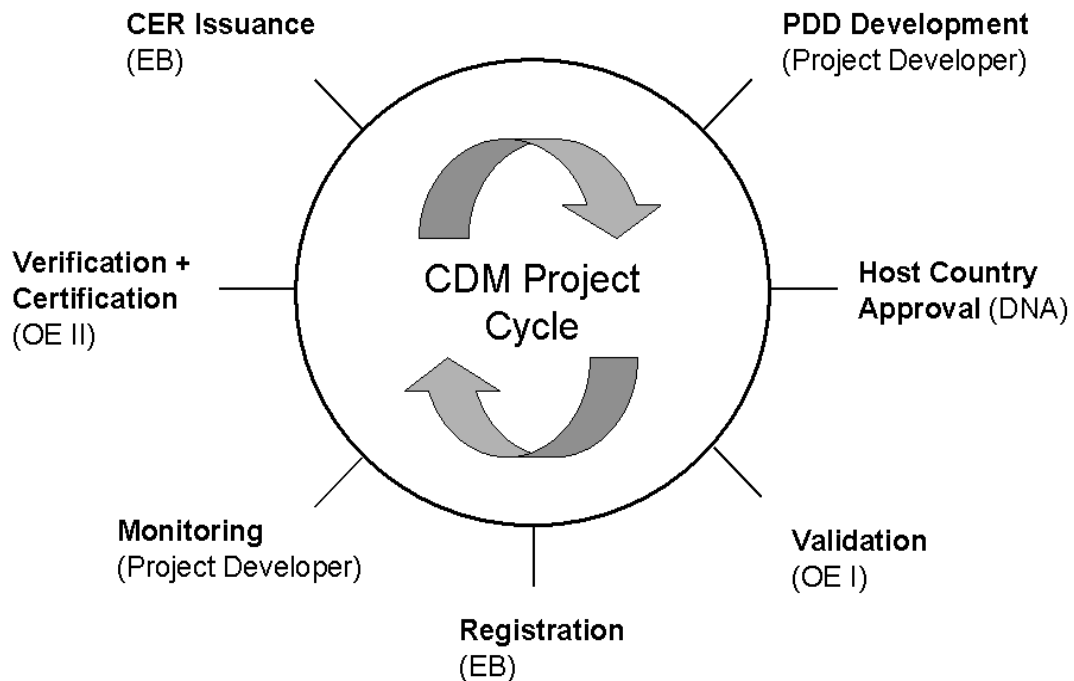
verifier that the CDM project achieved the emission reductions as stated in the verification report (see *ibid*, -/CMP (Article 12), Annex, para 61).

3.2.3.7 Issuance of CERs

The EB will issue the CERs upon receipt of the certification report. The EB will issue the CERs into the account of the project developer. However, it will deduct and transfer a share of 2% of the CERs in the account of the adaptation fund³⁰ (see *ibid*, -/CMP (Article 12), Annex, para 65-66).

³⁰ The CERs will be held and transferred in electronic accounts at the so called CDM registry. (see *ibid*, -/CMP (Article 12), Annex, Appendix D, para 1).

Figure 2: The CDM Project Cycle



Source: own figure

3.2.4 Latest Developments in the Approval of Methodologies and Registration of CDM Projects

At the 11th EB meeting in October 2003 the EB in total approved the sixth baseline and monitoring methodology from a total of 33 proposed methodologies submitted since its operation. (see UNFCCC 2003b, p. 2f.). These two projects are in the validation stage and eventually will be registered by the EB. The other 27 methodologies were rejected but may be re-submitted.

The most prominent reason for rejection of the baseline methodologies was the lack of proof that the project activity is not the baseline scenario and therefore not additional (see JIN 2003, p. 3). Other reasons have been lack of comprehensible data, monitoring techniques and illustration of the methodologies (see Jotzo 2003, p. 4).

3.3 Economic and Institutional Principles of CDM

It is the aim of this section to outline the economic and institutional principles of CDM. These principles lay the foundation for an understanding of the impact of transaction costs on the Kyoto Mechanisms and the definition of transaction costs of CDM projects as used in this study. The section is organised as follows. Section 3.3.1 briefly outlines the economic rationale for the Kyoto Mechanisms. Subsequently, section 3.3.2 introduces potential participants in CDM as well as their options and incentives for and deterrents to participation. Finally, section 3.3.3 presents the institutional design options for CDM projects.

3.3.1 *The Economic Rationale for the Kyoto Mechanisms*

The Kyoto Mechanisms are based on the theory of tradable emission permits³¹. The basic rationale for emissions trading is that it allows the realisation of an emission reduction target at minimum costs (see Montgomery 1972, p. 409). Two types of emissions trading systems exist.

The first one is referred to as a cap-and-trade system (see Ellermann et al. 2003, p. 4). Here at least two emitters exist that are subject to an overall emissions limit. Each emitter will be allocated emission allowances³² which they are allowed to trade among each other and whose sum is equivalent to the overall limit. Theory says that the provision for trading of allowances will enable the cost-effective compliance of the emitters with their emissions target by equalising the marginal abatement costs among them. In this sense IET can be interpreted as a cap-and-trade GHG emissions trading system among Annex B countries (see Janssen 2001, p. 52).

A second type of emissions trading is the baseline-and-credit system (see Ellermann et al. 2003, p. 4). Here emission credits³³ are provided to emitters that reduce emissions below a pre-defined baseline. Once the emission reduction has been certified these credits can be traded. They can then be bought and used for compliance by emitters which are subject to emission targets in order to allow for compliance at lower cost. In this sense ERUs and CERs from JI and CDM projects respectively can be interpreted as credits stemming from baseline-and-credit systems (see Janssen 2001, p. 52). Hence, the Kyoto Mechanisms provide for international trading of the GHG emission permits

³¹ A “permit” is defined as a legal document which gives the owner the right to emit a certain amount of certain types of pollutants (see Ellermann et al. 2003, p. 48). In the following trading of emission permits is referred to as “emissions trading”.

³² In a cap-and-trade system emission permits are referred to as “allowances” therefore this system is also referred to as “allowance-based trading” (see Rosenzweig et al. 2002, p. 4).

³³ In a baseline-and-credit system emission permits are referred to as “credits” therefore this system is also referred to as “credit-based trading” (see *ibid*, p. 4).

AAUs, ERUs and CERs in order to allow the realisation of the internationally agreed GHG reduction target at minimum costs by equalising the marginal abatement costs worldwide.

3.3.2 *Potential Participants in CDM – Options, Incentives and Deterrents*

This section presents the potential participants in CDM and elaborates on their options as well as on their incentives for and deterrents to participation. Potential participants are Annex B countries³⁴, Non-Annex I countries and the private sector (see Arts et al. 1994, p. 34ff.; see Dudek/Wiener 1996, p. 9f.; see Dutschke/Michaelowa 1998, p. 13ff.). They can choose between various forms of participation.

The initial concept of CDM as discussed among climate policy experts foresaw investment from Annex B country governments or private companies in potential CDM projects supplied by the host country's government or private companies in return for CERs (see Janssen 2001, p. 45). This meant that the host country government or private company would not have invested in the project. Instead it would have solely supplied GHG mitigation projects for investment from an Annex B country participant. Tietenberg et al. (1999) highlighted that CDM projects would not necessarily involve investment from abroad but that Non-Annex I country participants could “*already finance projects on its own and sell credits earned*” (Tietenberg et al. 1999, p. 49). In this case participation of Annex B countries in CDM would be limited to the purchase of CERs from Non-Annex I participants which have developed and financed the projects on their own. In such a case Annex B country participants could buy CERs from Non-Annex I participants either after the reduction is achieved (Direct Purchase Agreement – DPA) or ahead of their issuance for a pre-agreed price at a certain time in the future (Emission Reduction Purchase Agreement – ERPA). A DPA could be traded in form of a spot, forward or option contract whereas the ERPA would necessarily involve a forward or option contract (see Janssen 2001, p. 34).

Table 1 sums up the options the major participants have for participation in the CDM.

³⁴ All Annex I countries can participate in CDM. However, countries that are not part of Annex B of the Kyoto Protocol are not considered here as they have not committed themselves to a GHG target.

Table 1: Options for Participation in CDM

Potential Participant	Form of Participation				
	Supplier	Seller	Investor	Buyer (ERPA)	Buyer (DPA)
Government, Non-Annex I Country	X	X	X		
Government, Annex B Country			X	X	X
Company, Non-Annex I Country	X	X	X		
Company, Annex B Country			X	X	X

Source: own table

3.3.2.1 Annex B Countries

The primary incentive for Annex B countries to engage in CDM is to allow a cost-effective realisation of its internationally agreed GHG target. The government can foster private sector engagement in CDM by formulating targets in the context of a national or supra-national GHG emissions trading scheme³⁵ for (groups of) GHG emitters that are allowed to use CERs for compliance. If nevertheless the internationally agreed target is not reached, the country can then, as a “last-minute measure”, buy CERs via DPAs. However, it is also conceivable that Annex B country governments want to engage in CDM via investment, DPAs or ERPAs as long-term strategy for reaching their targets.

The usage of CDM shifts the necessary structural change in Annex B countries to future periods³⁶ (see Michaelowa 1997, p. 56f.). At the same time it represents an opportunity for national industry to export technology and therefore can limit the resistance from national industry to national climate policy (see Greiner 2000, p. 49ff.). Furthermore, Annex B countries anticipate that CDM projects raise the awareness for climate change issues in Non-Annex I countries and strengthen their willingness to reduce emissions in the future (see Parikh 1994, p. 15). However, if emission reductions are achieved abroad Annex B countries do not profit from the positive externalities the emission reduction measure might incorporate (e.g. reduction of local pollutants) (see Kopp/Bräuer 1998, p. 11).

³⁵ The Annex B country could also set incentives for CERs acquisition via taxes or command and control measures (see Michaelowa 1997, p. 21).

³⁶ Michaelowa (1997) assumes that the pressure on OECD countries to commit to further emission reductions in possible future commitment periods will mount (see Michaelowa 1997, p. 56)

3.3.2.2 *Non-Annex I Countries*

A major incentive for Non-Annex I countries to host CDM projects is that foreign investment in CDM projects can result in positive externalities. Generally, the host country will welcome the transfer of capital, technology and know-how from investments in CDM projects as well as additional job creation and a cutback in local pollutants accompanied with it (see Kopp/Bräuer 1998, p. 10f.). However, this transfer will not take place if the projects are financed by entities from within Non-Annex I countries.

A Non-Annex I country could have an incentive to participate in order to gain a share from the CERs generated by the project and sell them on the market. The form of participation is decisive. Should Non-Annex I countries decide to solely supply potential projects (e.g. from public enterprises) to foreign investors they will usually gain nothing but positive externalities (see *ibid.* 1998, p. 9f.). However, Non-Annex I countries could invest in projects on their own or in a partnership in order to attract investment and/or get a share in CERs. If they choose to do so, they have to weigh the gains from positive externalities respectively the CER value against the (share in) project costs.

Some potential host countries have expressed their concern that CDM projects use up “cheap” emission reduction options. They anticipate that once they have committed themselves to an emissions target at a later date that this target can only be achieved at higher costs (see INC 1993, p. 16f.). This is questionable because reduction options cannot be “stored” over time due to technological progress and changes in economic activity (see Michaelowa 2001b, p. 2).

3.3.2.3 *Private Companies*

Via investment in CDM projects or purchase of CERs private companies from Annex B countries can ensure a cost-effective realisation of their emission targets³⁷. Private companies in Non-Annex I countries could participate in CDM as follows. They could either supply a CDM project to a potential investor, invest in a project in co-operation with an Annex B country investor or fully finance a project for later CER sales. When

³⁷ So far evidence exists that private companies from Annex B countries have traded GHG emissions in the form of Verified Emission Reductions (VERs) mainly for compliance with voluntary corporate commitments and for gaining experience with emissions trading (see Rosenzweig et al. 2002, p. 7f.). Very likely these VERs traded will not be eligible for emissions trading under the Kyoto Protocol as they do not conform with its’ rules (see *ibid.*, p. 32). In the future it is well conceivable that private companies may want to use CERs for compliance with voluntary targets. More important, some national governments do consider integrating CDM in existing or proposed national or supra-national emission trading schemes under which private companies face GHG reduction targets. See section 3.4.1 for an account of such schemes.

solely supplying a project to an investor their incentive is to benefit from positive externalities. If the company decides to invest fully (or partly) in the project it has to weigh the gains from positive externalities and the revenue from the sale of CERs respectively against the (share in) project costs.

Besides private companies can engage in CDM as project consultants, DOEs or brokers that matchmake potential buyers and sellers of CERs (see *inter alia* Spalding-Fecher 2002, p. 8ff. and Rosenzweig et al. 2002, p. 19f.).

3.3.3 Institutional Design Options for CDM Projects

The way investments are channelled into CDM projects as well as the responsibilities and the extent of involvement of the participants in CDM depends on the institutional design option chosen for a CDM project. The most common design options discussed are the bilateral, multilateral and unilateral design option (see *inter alia* Michaelowa 1997, p. 106ff.; Baumert/Kete/Figueroa 2000, p. 3ff. and Stewart et al. 2000, p. 19ff). The different options are briefly outlined in the following.

3.3.3.1 Bilateral

In a bilateral project architecture project suppliers and investors negotiate and decide on the project development, project financing and sharing of costs and credits on a project-specific basis (see Stewart et al. 2000, p. 20). Governments or companies from Annex B countries are direct participants in the project and directly invest in the project.

3.3.3.2 Multilateral

In the multilateral project design option single investors do not directly invest in a CDM project by themselves but deposit their money in an independent multilateral fund which instead invests in a portfolio of projects on behalf of the investors (see Michaelowa 1997, p. 106; see Baumert/Kete/Figueroa 2000, p. 4). The fund operates as follows. Potential project suppliers design CDM projects and compete for the fund's resources. The depositors receive CERs in proportion to their share in the fund.

3.3.3.3 Unilateral

In case of an unilateral design the project supplier is the project owner who designs, implements and finances the project with his own resources (see Stewart et al. 2000, p. 22f.). He takes on all associated risks, including the risk to find a buyer willing to engage in a DPA or ERPA. It is conceivable that potential CDM projects that start off as

unilateral projects are later “converted” into bi- or multilateral projects³⁸. After the project has been implemented it cannot be converted into a bi- or multilateral project as a direct investment in the project is not possible anymore³⁹.

Therefore, if a government or private company from an Annex B country or a multilateral fund purchases CERs via an ERPA or DPA the underlying project will still be an unilateral project.

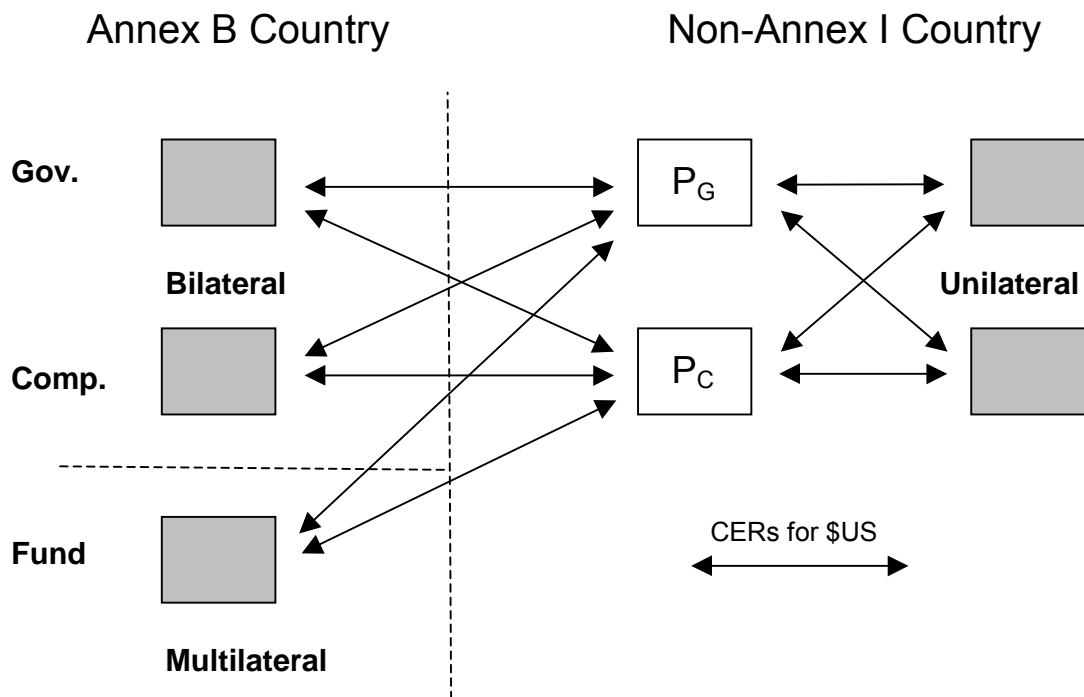
Figure 3 provides an overview of the different institutional project design options the major participants can use for CDM project design. The project P_G represents a CDM project supplied by a governmentally owned company in the host country and the project P_C represents a CDM project supplied by a private company in the host country. The arrows represent the flow of money from the investing party in exchange for CERs⁴⁰.

³⁸ The project supplier might be interested in finding an Annex B country investor in order to minimise the risk not to find a buyer for the CERs.

³⁹ As long as investments in the unilateral project are still possible the unilateral project developer will be referred to as the “project supplier”. Once the project is implemented he will be referred to as the “seller” of CERs. Please note that this narrows down the definition of “seller” of CERs. Entities selling CERs that they have acquired by either investing in CDM projects or purchasing them from CER “sellers” do not fall within this definition. They are not considered in this study.

⁴⁰ The exchange of CERs from unilateral projects via ERPA or DPA between the seller and the Annex B country participant is not displayed.

Figure 3: Institutional Project Design Options for CDM Projects



Source: own figure

3.4 The CER Market

As described AAUs, ERUs and CERs are the emission permits that can be traded and used for compliance with the internationally agreed GHG targets. Consequently, one can expect a single international permit price to emerge assuming a perfect international GHG market (see Jotzo/Michaelowa 2002, p. 183). In this market CERs will directly compete with domestic abatement measures, AAUs and ERUs. Existing estimates on the volume of CERs traded in the international GHG market for 2010 range from 220 – 2,650 Mt CO₂⁴¹ (see KfW 2001, p. 12).

However, a single international GHG market does not yet exist. In the meantime the situation is somewhat different. Currently, the market for emission permits is fragmented and CERs are not eligible in any market. Two developments that are relevant for the CDM can be observed.

⁴¹ The broad range of market volume results from the different basic assumptions applied (see KfW 2001, p. 11ff.).

First, countries or groups of countries have set up or are in the process of setting up national or supra-national emissions trading schemes for selected groups of emitters in which national allowances are traded. In 2008 they can be expected to be linked to the international GHG market under the Kyoto Protocol (see Butzengeiger et al. 2003, p. 220). Among those that may allow for the use of CERs is the Danish Emissions Trading Scheme and the proposed EU Emissions Trading Scheme (EU-ETS) (see Rosenzweig et al. 2002, p. 34).

Second, national governments as well as private entities have set up or are in the process of setting up institutions that aim to purchase CERs before 2008.

This section gives an introduction to the current state of the CER market and an outlook on the development of the CER market until 2008 (3.4.1). Finally, the findings of a recent modelling study on the market for CERs in the first commitment period assuming a single perfect international GHG market will be presented (3.4.2).

3.4.1 *The Current Market for CERs and Future Prospects until 2008*

A number of prospective buyers that aim to purchase CERs via ERPAs and already have positioned themselves in the market will be presented (3.4.1.1). Subsequently, available information on the current supply of CERs is given (3.4.1.2). Finally, the future prospects of the CER market until 2008 are briefly discussed (3.4.1.3).

3.4.1.1 *Current Demand for CERs*

The **Prototype Carbon Fund (PCF)** was set up by the World Bank in 1999. It is a closed-end fund and is scheduled to terminate in 2012. It is a public-private partnership that consists of six governments as well as 17 private cooperations. The fund has a total budget of 180 million \$US of which 105 million \$US are designated for the purchase of CERs via ERPAs⁴² (see de Coninck/van der Linden 2003, p. 9). The PCF CER target price is 3.15 \$US/t CO₂e averaged across the portfolio (see de Gouvello/Coto 2003, p. 9). Considering the total budget this would translate into a maximum of around 33 Mt CO₂e to be purchased by the PCF.

On behalf of the **Government of the Netherlands (GoN)** an entity called Senter has set up the Certified Emission Reduction Procurement Tender (CERUPT). It was launched in 2001 in order to buy ERUs and CERs via ERPAs (see Senter 2002). From 80 offers received Senter is about to contract CERs from 18 projects amounting to around 16 Mt CO₂e (see de Coninck/van der Linden 2003, p. 11). The prices paid for the CERs range

⁴² Originally, the PCF was set up to directly invest in CDM projects but at an early implementation stage the structure has been changed. Under the new structure it is simply purchasing CERs and ERUs (see Janssen 2001, p. 219).

between 3.9 - 6.5 \$US/t CO₂e⁴³ (see Senter 2001, p. 5). The GoN also engaged in a contract with the Netherlands Clean Development Facility (NCDF) for purchasing 32 Mt CO₂e (see de Coninck/van der Linden 2003, p. 9).

The **Government of Finland** (GoF) launched the Finnish JI/CDM Pilot Programme in 2003. It aims to purchase CERs from small-scale CDM projects via ERPAs. It intends to initiate preliminary discussions with 7 project developers that have offered CERs in the price range from 2.9 - 3.8 \$US/t CO₂e (see MoFA 2003a). The total amount of CERs that the GoF wants to purchase is not publicly available.

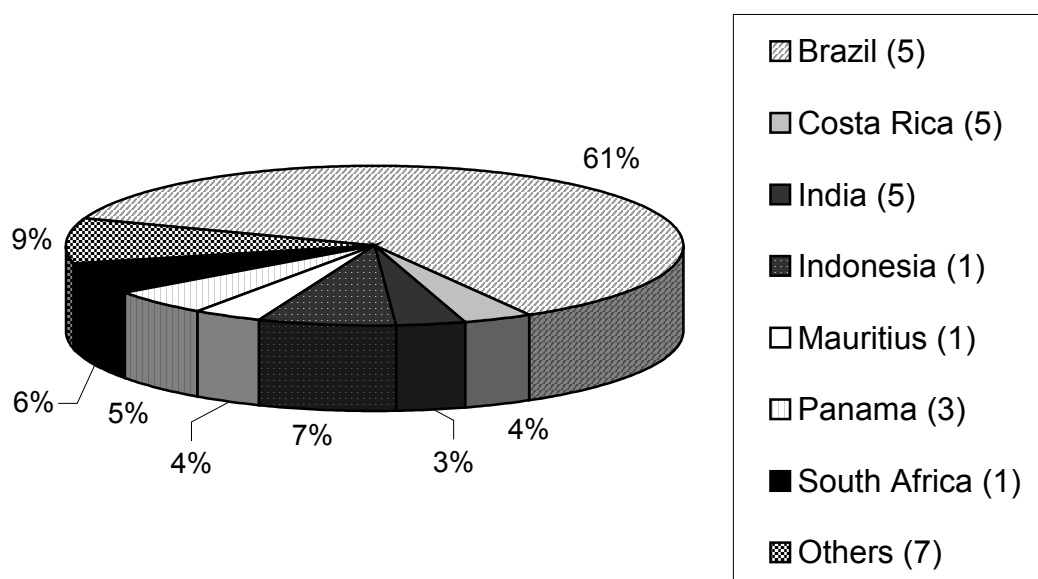
The World Bank has recently set up the **Community Development Carbon Fund (CDCF)** and the **Bio Carbon Fund (BCF)**. The CDCF has a target capitalisation of \$US 100 million and aims to purchase CERs from small-scale projects with “*measurable sustainable development benefits*” via ERPAs (see CDCF 2003, p. 1). The fund is prepared to pay 5 - 7 \$US/t CO₂e. Considering the funds’ budget this would translate into around 15 to 20 Mt CO₂e. The BCF targets CERs from sink projects and is not yet operational.

3.4.1.2 *Current Supply of CDM Projects*

Currently, between 600 and 650 CDM project ideas exist worldwide of which around 45 may end up generating CERs (see Point Carbon 2003a, p. 5). The following two figures have been derived from available information on 28 potential CDM projects for all of which the PDD has been completed. An overview of the project details can be found in appendix I. All projects are unilateral projects. For each project either PCF, Senter or NCDF has the exclusive right to buy the CERs. In total they are expected to lead to an exchange of CERs of around 75 Mt CO₂e. Figure 4 shows the distribution of the potential CDM projects by volume of anticipated emission reduction and host country. The number in brackets represents the total number of potential CDM projects in the respective host country.

⁴³ Senter pays 6.5 \$US for CERs from renewable energy projects (excl. biomass), 5.2 \$US for energy-efficiency and biomass projects and 3.9 \$US for other project types (see Senter 2001, p. 5).

Figure 4: Share in Total Volume of CERs of Selected Potential CDM Projects by Host Country

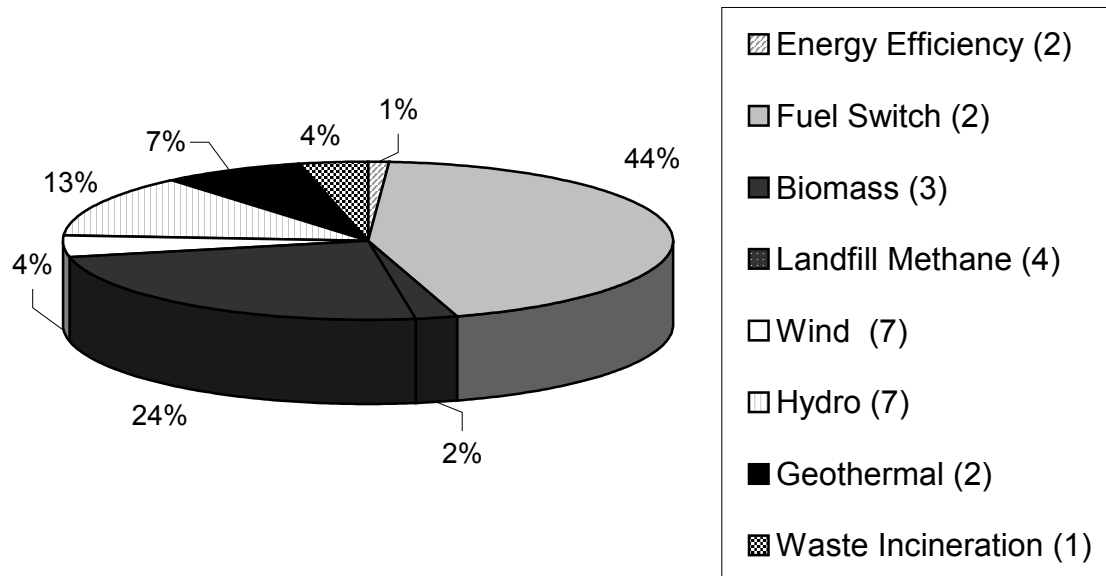


Source: see appendix I

It can be observed that Brazil, India and Costa Rica have so far received the most attention from project developers. In each country 5 projects are being developed. However, in appendix I it can be observed that the average size of the projects' emissions reduction vary significantly. Among the three countries projects in Brazil have very high emission reductions compared to projects in India and Costa Rica.

Figure 5 shows the project types by share in total anticipated volume of CERs. The number in brackets represents the total number of projects of the respective type.

Figure 5: Share in Total Volume of CERs of Selected Potential CDM Projects by Project Type



Source: see appendix I

Among all projects hydro and wind projects followed by landfill methane and biomass projects received the most attention when considering the number of projects carried out. However, in appendix I it is observable that landfill methane projects generally achieved significantly higher emission reductions than renewable energy projects. The highest emission reductions are achieved by the fuel switch projects.

Bearing the small number of projects observed in mind one can cautiously conclude that Brazil, India and Costa Rica have so far been perceived as attractive countries for CDM development. Moreover, renewable energy projects received a lot of attention while fuel switch and landfill methane projects supply large quantities of CERs.

3.4.1.3 Future Prospects of the CER Market until 2008

The Danish and Austrian Governments have announced plans to purchase CERs to (partly) meet their Kyoto targets (see Environmental Finance 2003, p. 8). The amounts planned to be purchased are not available.

The EU-ETS is scheduled to start in 2005. ERUs and CERs will most likely be eligible under a number of restrictions from 2008 onwards⁴⁴ (see Butzengeiger et al. 2003,

⁴⁴ CERs and ERUs have not been included in the original draft of the European Commission (EC) on the EU-ETS. The modalities of their potential inclusion have been later specified in a separate draft directive. The final content of the directive is not yet clear (see Butzengeiger et al. 2003, p. 226f.).

p. 226f.). If demand for CERs from the EU-ETS will come before 2008 depends on the final version of the directive which will regulate the terms for inclusion of CDM in the EU-ETS. The amount of demand will depend on the national allocation plans of the EU member states which are currently under preparation (see Butzengeiger et al. 2003, p. 225). Current forward price quotes for EU allowances for 2005 as well as price estimates from experts lie around 5.9 – 8.2 \$US/t CO₂ (see Tangen 2003, p. 8ff.; see Point Carbon 2003b).

Despite the estimated CER market volumina of 220 – 2,650 Mt CO₂e in 2010 it has been recently estimated that only 3.35 Mt CO₂e will have entered the market by 2005 (see Point Carbon 2003a, p. 1). This low amount is partly due to delay in the approval process at the EB, potential risk of non-approval by the EB and possible project implementation delay (see *ibid*, p. 1). Possibly more important is the fact that most of the CERs earned from the projects might be banked for crediting in 2008 and will not enter the free market (see *ibid*, p. 8). This for example might very well apply for all CERs potentially contracted by governmental acquisition programmes such as CERUPT.

The CER market is still characterised by a considerable level of uncertainty especially as the Kyoto Protocol has not entered into force (see de Coninck/van der Linden 2003, p. 21). As described the demand side is currently dominated by forerunners which are prepared to take the risks of purchasing CERs before the entering into force of the Kyoto Protocol. However, one can expect a higher demand to enter the market upon Russias' ratification (see *ibid*, p. 21).

According to Point Carbon (2003) one can assume to see modest competition for CERs at price levels around 3.5 – 5.9 \$US/t CO₂e until 2008 (see Point Carbon 2003a, p. 1).

3.4.2 The Findings of a CER Market Modelling Study for the First Commitment Period

Jotzo and Michaelowa (2002) have estimated a single international permit price as well as the share of the CERs in the international GHG market for the first commitment period via a supply/demand model⁴⁵ (see Jotzo/Michaelowa 2002, p. 183). They modelled the supply and demand curves for the Kyoto Mechanisms and the domestic abatement options on the basis of marginal cost curves for CO₂⁴⁶.

⁴⁵ A number of studies that estimate the market prices of the international GHG market under the Marrakech Accords have been undertaken (see *inter alia* Elzen/de Moor 2001 and Grütter 2001). However, the study done by Jotzo and Michaelowa (2002) is the most recent and is therefore presented here. An overview of the other studies can be found in Michaelowa (2001), p. 29ff.

⁴⁶ For a detailed account of the modelling method applied as well as its limitations see Jotzo/Michaelowa (2002).

The authors estimate that CERs will have a share of 372 Mt CO₂/a in the international GHG market at a price of 3.78 \$US/t CO₂ for the first commitment period (see *ibid*, p. 185). This translates into a 32% share of CERs in the required emission reductions from Annex B countries relative to the business-as-usual scenario of 1169 Mt CO₂/a (see *ibid*, p. 184).

Jotzo and Michaelowa (2002) assume that of these 372 Mt CO₂ emission reductions from CDM projects 67 Mt CO₂ will come from CDM sink projects (see *ibid*, p. 185). Table 2 shows the modelled global distribution of non-sink CDM projects up to the end of the first commitment period.

Table 2: Global Distribution of CER Supply from Non-Sink CDM Projects in the First Commitment Period

Country/Region	CER Sales (Mt CO ₂ /a)	Share of Global Supply (%)
China	144	47
India	36	12
Indonesia	10	3.3
Other Asian Countries	29	9.0
Middle East	34	11
Africa	34	11
Brazil	1.9	0.6
Other Latin American Countries	18	6.0
Total	305	100

Source: see Jotzo/Michaelowa (2002), p. 187

When comparing the findings of Jotzo and Michaelowa (2002) with the prices offered by buyers in the emerging CER forward market it can be observed that they lie in the same order of magnitude. Therefore, it can be cautiously concluded that a CER market price between 3 – 4 \$US/t CO₂ for the first commitment period seems to be likely. The findings of table 2 suggest that China and India can be expected to be the dominant players in the supply market of CERs. Together they cover 50% of global supply.

4 Transaction Costs of CDM Projects

This chapter starts with a general definition of transaction costs according to neo-institutional economics (4.1). Afterwards, the role of transaction costs in environmental externalities with special regard to climate change as an externality is highlighted (4.2). Subsequently, transaction costs of CDM projects are defined for the purpose of this study, their impact on the use of the CDM illustrated and a brief review of the qualitative discussion on the magnitude of transaction costs of the different Kyoto Mechanisms presented (4.3). Afterwards, on the basis of the definition of transaction costs of CDM projects a compilation of transaction cost components of CDM projects is established. Each transaction cost component is defined and it is discussed on which factors their magnitude might depend on (4.4). Subsequently, preliminary estimates on the magnitude of transaction costs of CDM projects are presented and their impact on the viability of CDM projects outlined (4.5). Finally, the above sections are summarised (4.6) and implications for the design of empirical research on the transaction costs of CDM projects are highlighted (4.7).

4.1 Transaction Costs in Neo-Institutional Economics

Transaction costs were first discussed by Coase (1937). He introduced the term in his economic analysis on the optimal size of an undertaking and showed that market transactions come with costs (see Coase 1937, p. 395). Since then various definitions of transaction costs have emerged⁴⁷ of which the definition of Arrow (1969) that transaction costs are the “*running costs of an economic system*” is the most general (Arrow 1969, p. 48). Richter and Furubotn (1999) subdivides transaction costs into market transaction costs, corporate transaction costs⁴⁸ and political transaction costs (see Richter and Furubotn 1999, p. 50ff.).

This chapter gives an introduction to the role of transaction costs in markets generally and an overview of the categories of market transaction costs (4.1.1). The concept of political transaction costs is also illustrated (4.1.2). Corporate transaction costs are not further considered as they are not relevant for this study. They accrue from setting-up, maintaining and changing a company as well as from running it (see Richter and Furubotn 1999, p. 53f.).

⁴⁷ Richter and Furubotn (1999) says that so far few efforts have been made to produce an exact empirical definition of transaction costs (see Richter and Furubotn 1999, p. 56).

⁴⁸ Translation from German expression “*Unternehmenstransaktionskosten*” (Richter and Furubotn 1999, p. 49).

4.1.1 *Market Transaction Costs*

Stavins (1995) has shown that transaction costs play a pivotal role in markets as their most obvious impact is that they increase the costs to each participant of the prospective exchange. The participants, among other activities, must find one another, need to communicate and exchange information (see Stavins 1995, p. 134). If the participants are economically rational transaction costs can even prevent an exchange from happening once the transaction costs exceed a participants' benefit from the exchange (see Coase 1960, p. 10).

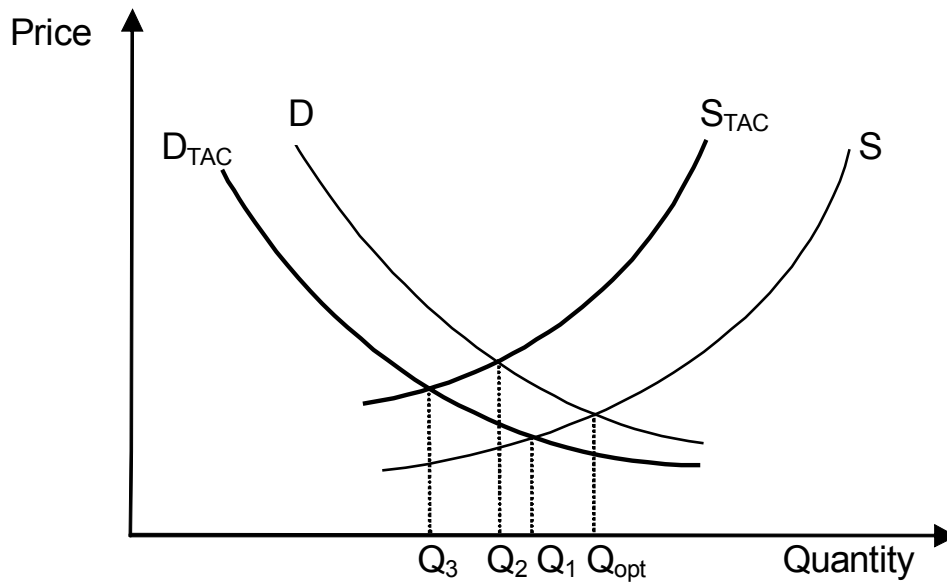
Stavins (1995) defines transaction costs as the difference between the buying and the selling price in a market⁴⁹ (see Stavins 1995, p. 137). Transaction costs increase the buyer's cost and/or lower the supplier's (net) price and result in a shift of the demand and supply curves. The resulting quantity traded will be lower than it would be in the absence of transaction costs (see *ibid*, p. 139). Figure 6 illustrates this. The curves S and D represent the supply and demand in a market without transaction costs. The market clears at a quantity of Q_{opt} . If either or both parties to the transaction bear transaction costs (illustrated by the adjusted curves S_{TAC} and D_{TAC}) the quantity traded will always be lower than Q_{opt} ⁵⁰. The shape of the curves S_{TAC} and D_{TAC} (that e.g. varies with the relation between transaction costs and total quantity traded) determine the specific relation between the traded quantities Q_1 , Q_2 and Q_3 .

Generally, the higher the transaction costs the lower the traded quantity and the higher the price will be.

⁴⁹ In his analytical model Stavins (1995) regards transaction costs as direct financial costs for brokerage services (see Stavins 1995, p. 134).

⁵⁰ As long as the marginal cost functions are continuous over the relevant ranges (see Stavins 1995, p. 139).

Figure 6: Supply and Demand in the Presence of Transaction Costs



Source: see Dudek/Wiener (1996), p. 16

Dudek and Wiener (1996) have done a compilation of market transaction cost categories that encompasses search costs, negotiation costs, approval costs, monitoring costs, enforcement costs and insurance costs (see Dudek/Wiener 1996, p. 15). Table 3 provides an overview of the categories used by the authors and gives examples for in which such forms costs can accrue.

Table 3: Market Transaction Cost Categories

Cost Category	Type of Costs
Search Costs	<ul style="list-style-type: none"> - Costs of finding interested partners to the transaction (e.g. advertisements and brokers) - Costs for communication (e.g. expenses for telephone and sales representatives) - Costs for price information and quality control (e.g. agents)
Negotiation Costs	Costs for coming to an agreement (e.g. time, visits and drafting of contract)
Approval Costs	Costs that arise when the trade must be approved by a government agency (e.g. modifications)

Monitoring Costs	Costs to observe the transaction and to verify adherence to the terms of contract (e.g. hiring a verification service)
Enforcement Costs	Costs to insist on compliance once divergence from contract is detected (e.g. suing the seller in court)
Insurance Costs	Costs for insurance policy (e.g. for compensation in the event of loss of the good)

Source: see Dudek/Wiener (1996), p. 15; see Richter and Furubotn (1999), p. 50ff.

4.1.2 Political Transaction Costs

Market transactions and corporate transactions take place against a well defined political background. According to Richter and Furubotn (1999) this means that local, national or global communities exist which are structured in a certain manner and therefore create a distinct institutionalised framework in which such transactions take place (see Richter and Furubotn 1999, p. 54). The establishment of such a structure causes what Richter and Furubotn (1999) calls political transaction costs that can be divided into the two following categories (see *ibid*, p. 54f.).

The first category contains the costs for establishing, maintaining and changing of such a structure (e.g. costs for state authority, jurisdiction, armed forces and education systems). Other authors refer to these costs as development costs (see Haddad and Palmisano 2001, p. 442), implementation costs (see Banuri et al. 2001, p. 52) or ex-ante transaction costs (see Woerdman 2002, p. 218).

The second category consists of the running costs of the community (e.g. running expenditures for the jurisdiction, armed forces, etc).

4.2 The Role of Transaction Costs in Environmental Externalities with Special Regard to Climate Change as an externality

Anthropogenic climate change is a negative external effect caused by man-made GHG emissions (see Markandya et al. 2001, p. 461ff.). Coase (1960) has demonstrated that in the theoretical event of absence of transaction costs, bargaining between the polluter and the victim of the pollution would lead to a full internalisation of the negative external effect⁵¹ (see Coase 1960, p. 10). This means that in a theoretical world without transaction costs climate change would occur at a socially desirable level. In reality such bargaining between the victims of climate change and the GHG emitters would cause

⁵¹ Preconditions are the external evaluation of the environments' quality and a pareto-efficient resource allocation (see Brockmann et al. (1999), p. 26f.)

considerable transaction costs (e.g. through identifying all affected parties, negotiating an agreement, monitoring the compliance) and could potentially outweigh the benefits of such a bargain and as a result impede its' realisation (see Brockmann et al. 1999, p. 27). Dudek and Wiener (1996) say that the UNFCCC *“itself functions as a mechanism to surmount these transaction costs by fostering a multinational bargain”* (Dudek/Wiener 1996, p. 18). To put it another way and following Richter and Furubotn (1999) one could say that the Parties to the UNFCCC take on political transaction costs in order to create a regulatory structure for GHG emissions. Political transaction costs are not further considered in this study.

4.3 Transaction Costs of CDM Projects

Stavins (1995) showed that generally in every emissions trading system the cost-effective equilibrium where marginal abatement costs are equated across all emission sources will not be achieved if transaction costs exist (see Stavins 1995, p. 138). He stated that in every emissions trading system not the marginal abatement costs are equalised among the sources but that the sum of marginal abatement costs and marginal transaction costs are equilibrated (see *ibid*, p. 137). Therefore, the quantity of permits traded will be lower and the permit price higher than in the theoretical situation without transaction costs.

For the Kyoto Mechanisms transaction costs mean that their use will be lower than without transaction costs, resulting in higher costs for the accomplishment of the internationally agreed GHG reduction target.

Transaction costs of CDM projects so far have not been unambiguously defined. PWC (2000) defines transaction costs of CDM projects as the costs that accrue to project developers from the tasks to be performed in the CDM project cycle (see PWC 2000, p. 12). In addition to this definition Michaelowa and Stronzik (2002) incorporate search and negotiation costs that arise from bi- or multilateral CDM project development in their definition (see Michaelowa/Stronzik 2002, p. 10). Fichtner et al. (2003) subdivide transaction costs of CDM projects into indirect costs and additional transaction costs (see Fichtner et al. 2003, p. 3). The latter is based on the PWC definition of transaction costs whereas the former represents the costs an investor pays for project development abroad (e.g. costs for arranging the fuel contracts and the financing before financial closure of the project as well as costs for consultancy services and insurance). Hence, the authors implicitly assume that the project developer is a bi- or multilateral project developer as they analyse the transaction costs from the point of view of an investor from an Annex B country.

De Gouvello and Coto (2003) define transaction costs of CDM projects as costs that accrue from the CDM project cycle. They subdivide those costs in monetary and non-monetary costs (see de Gouvello/Coto 2003, p. 11ff.). The former cost category includes all the costs generated by additional services necessary to fulfill the tasks in the project cycle and that are carried out by the project developer himself, an external consultant or the OE. The latter cost category represents the 2% share of CERs that will be deducted for the adaptation fund, the proposed levy for administration of the EB and the costs from potential CERs retained by the host country⁵² (see *ibid*, p. 11).

In the context of this study transaction costs of CDM projects are defined as the sum of costs from the tasks to be performed in the project cycle that accrue until the end of the (last) crediting period as well as costs that accrue from search and negotiation activities involved in uni-, bi- and multilateral projects.

This definition does not cover transaction costs of CDM projects completely due to the rather broad definition of transaction costs in general. Consequently, this definition does not claim to be a general definition of transaction costs of CDM projects. It merely represents one of a number of possible approaches to apply the economic concept of transaction costs to CDM projects⁵³.

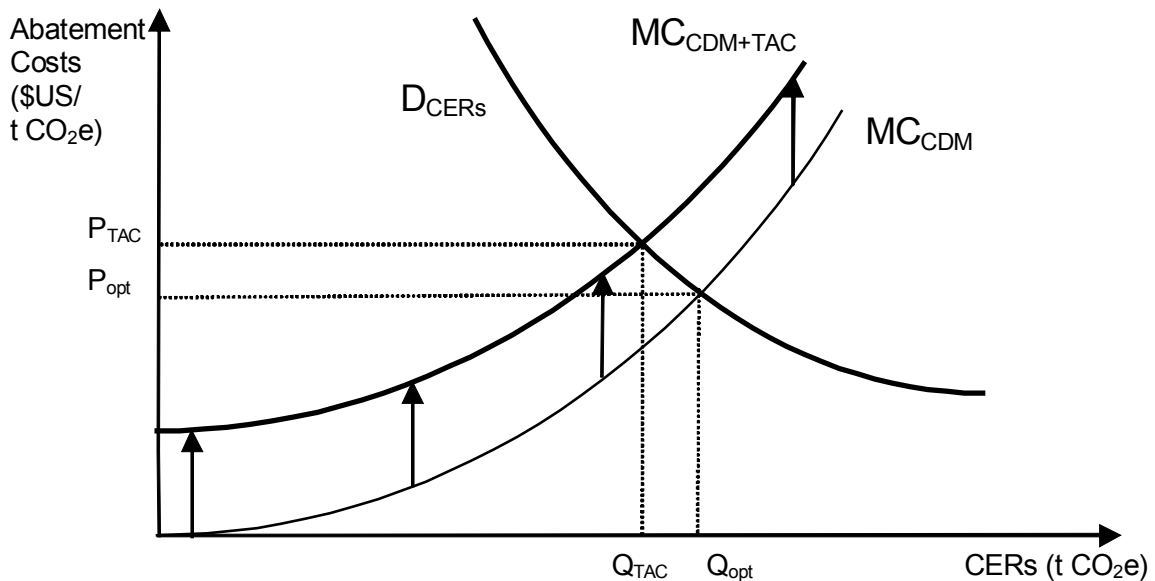
The impact of transaction costs on the use of the CDM is illustrated in figure 7. It depicts transaction costs that accrue to project suppliers/sellers of CERs as an increase in abatement costs. The lower cost curve (MC_{CDM}) represents the aggregated marginal abatement costs (supply of CERs) from potential CDM projects. It starts at zero costs as it is assumed that additionality tests will exclude projects with negative costs (see Michaelowa/Stronzik 2002, p. 8).

The demand for CERs is represented by the curve D_{CERs} . In a world without transaction costs CERs will be generated in the amount of Q_{opt} for a price of P_{opt} . With transaction costs the aggregated marginal abatement costs of potential CDM projects is represented by the higher costs curve ($C_{CDM+TAC}$) and CERs will only be generated in the amount of Q_{TAC} for a price of P_{TAC} .

⁵² Some countries are considering to tax CERs from CDM projects developed in their country (see Deodhar et al. 2003, p. 15).

⁵³ It is not within the scope of this study to discuss if and in how far the cost elements contained in this definition are transaction costs in the sense of neo-institutional economics. However, it should be noted that a number of costs that accrue from the project cycle could also be interpreted as CDM project development costs. However, in this study they are referred to as transaction costs of CDM projects as done in the studies reviewed from which the definitions of transaction costs have been presented in this section.

Figure 7: The Impact of Transaction Costs on the Use of the CDM



Source: own figure

It should be noted that for reasons of simplicity the above illustration assumes that transaction costs will be borne by the project supplier/seller. However, following the definition of transaction costs of CDM projects used in this study they will also accrue to the investor in a CDM project/buyer of CERs. Therefore, the quantity of CERs generated will fall and their price rise as transaction costs increase for either the investor/buyer or the project supplier/seller, or both.

Generally, the impact of transaction costs on the other Kyoto Mechanisms JI and IET is the same as outlined in figure 7 in the case of CDM (see Michaelowa/Stronzik 2002, p. 8). A number of authors state that the magnitude of transaction costs among the Kyoto Mechanisms will differ (see *inter alia* Grubb et al. (1999), p. 16; Michaelowa and Stronzik (2002), p. 8 and Woerdman (2002), p. 237). This difference in transaction costs will be an important factor determining the share of each permit type in the overall quantity of permits traded in the international GHG market under the Kyoto Protocol (see Michaelowa/Stronzik 2002, p. 8).

A comparison of estimates of the difference of transaction costs between the Kyoto Mechanisms gives a mixed picture. Some authors argue that JI and CDM will likely have higher transaction costs than IET (see *inter alia* Grubb et al. 1998, p. 16ff.; Vrolijk/Grubb 2000, p. 9 and Michaelowa/Stronzik 2002, p. 24f.) while Palmisano (1996) argues the other way around (see Palmisano 1996). One of the main arguments for assuming higher transaction costs for JI and CDM is that they require verification of

each generation of credits whereas allowances in IET will be automatically registered and checked (see Grubb et al. 1998, p. 22). Although some authors quote empirical evidence of transaction costs from both allowance trading⁵⁴ and credit trading⁵⁵ systems, Woerdman (2002) just recently criticised the comparison of transaction cost figures from the different systems on various grounds (see Woerdman 2002, p. 237ff.). He says that it is not surprising to obtain ambiguous results from comparing transaction costs in different markets because each market has its own typical transaction costs (see *ibid*, p. 237). Moreover he says that it is methodologically questionable to compare already existing allowance trading systems with the to be implemented IET because the latter will be different in geographical scope, sector coverage and emissions type (see *ibid*, p. 239). The same argument could also be valid for a comparison of transaction costs in existing credit systems and the CDM. For the time being it should be noted that it is not certain which transaction costs (will) accrue from the use of which Kyoto Mechanism. However, the quoted evidence suggests that the credit based systems CDM and JI will most likely entail higher transaction costs.

4.4 Transaction Cost Components of CDM Projects

On the basis of the definition of transaction costs of CDM projects this section aims to present a compilation of transaction cost components.

For this purpose transaction costs, arising from the CDM project cycle are subdivided into *pre-implementation transaction costs* (PITCs) and *implementation transaction costs* (ITCs). Together with the *market transaction costs* (MTACs) these form the three groups of transaction costs of CDM projects that will be considered in this study. These are once again subdivided into smaller components as shown in table 4. In this table *market transaction costs* are referred to according to the neo-institutional concept. The way this concept is applied to define search and negotiation costs in the context of CDM projects is outlined in 4.4.1. The transaction cost components accruing from the CDM project cycle will be defined and discussed in 4.4.2 and 4.4.3 respectively. Each cost component will again be subdivided into sub-cost components, if appropriate.

⁵⁴ US lead permit trading (see Fisher et al. 1996) and US SO₂ emissions trading (see Kerr/Maré 1997; see Klaasen/Nentjes 1997; see Grubb et al. 1998).

⁵⁵ US project-based mechanisms „offsets“ and „netting“ (see Palmisano 1996) and AIJ (see Michaelowa/Stronzik 2002, p. 12ff.).

Table 4: Transaction Cost Groups of CDM Projects and Their Cost Components

Market Transaction Costs (MTACs)	CDM Project Cycle Transaction Costs	
	Pre-Implementation Transaction Costs (PITCs)	Implementation Transaction Costs (ITCs)
Search Costs	PDD Costs	Monitoring Costs
Negotiation Costs	Approval Costs	Verification + Certification Costs
	Validation Costs	Adaptation Fee
	Registration Costs	Administration Costs

Source: own table

A number of authors have recently discussed options for reducing transaction costs of CDM projects (see *inter alia* EcoSecurities 2002, p. 19ff.; Michaelowa/Stronzik 2002, p. 26f. and Fichtner et al. 2003, p. 9f.). Evidence suggests that the magnitude of absolute transaction costs depend on factors such as project complexity and host country (see PWC 2000, p. 19; see EcoSecurities 2002, p. 19.; see Michaelowa/Stronzik 2002, p. 11f.). The demonstration of such a dependence will be important to propose measures for reducing transaction costs. Thus, for each cost component the factors they might depend on are discussed⁵⁶. The economic situation in the host countries will also have an effect on a number of cost components (i.e. the different purchase power parities). This fact will not be accounted for in the following chapters.

In January 2003, the EB adopted simplified CDM rules for small-scale projects. In section 4.4.4 it is briefly outlined which project types are eligible for the simplified rules and which transaction cost components are likely to be lower due to the simplification.

4.4.1 Market Transaction Costs

Search and negotiation costs for CDM projects have been defined for bi- and multilateral projects only (see Dudek/Wiener 1996, p. 20; see Michaelowa/Stronzik 2002, p. 10). However, the vast majority of potential CDM projects currently under development seem to be unilateral projects as shown in section 3.4.1.2. Therefore, this study has to close a definition gap and define search and negotiation costs for unilateral CDM projects.

⁵⁶ Please note that it is not within the scope of this study to discuss options for reducing transaction costs of CDM projects.

It also has to be mentioned at this stage that the compilation and definition of the sub-cost components for search and negotiation costs are based on observations made with unilateral projects in the current CER market. Observations of a similar kind have not been available for bi- and multilateral projects. Therefore, the sub-cost components identified for unilateral projects are also applied to bi- and multilateral projects in order to allow for a preliminary definition of these components.

4.4.1.1 Search Costs

In this study search costs in the context of bi- and multilateral projects are defined as the costs that the investor and the project supplier have to bear during their search for a mutually advantageous project development. In the context of unilateral projects search costs are defined as the costs that accrue to the seller and the buyer of CERs as they seek out partners for a mutually beneficial exchange of CERs.

From the perspective of a project supplier/seller the search for an investor/buyer will start once an idea for a CDM project is born⁵⁷. The search will be concluded once a potential buyer has expressed his interest to buy CERs or an investor has expressed his interest to invest in the project in return for CERs.

Search costs will accrue to both parties. In the following it is distinguished between the search costs faced by the project supplier/seller and search costs taken on by the investor/buyer. It is assumed that the project supplier/seller faces costs for finding an investor/buyer (4.4.1.1.1). Second, costs for finding a potential project supplier/seller will accrue to the investor/buyer (4.4.1.1.2). In the following sections the two sub-cost components are discussed in greater detail.

4.4.1.1.1 Costs for Finding a Potential Investor/Buyer

These costs are defined as the costs that accrue to the project supplier/seller until he and a potential investor/buyer have expressed their mutual interest to exchange CERs/jointly develop a potential CDM project in a Letter of Intent (LoI). Costs for finding an investor/buyer are once again subdivided into costs that accrue from the search activity of the project supplier/seller (4.4.1.1.1.1), costs that arise from the preparation of documentation of the project (4.4.1.1.1.2) and costs that arise once the project supplier/seller decides on and negotiates a LoI with the investor/buyer (4.4.1.1.1.3).

⁵⁷ This does not necessarily have to be the case. Projects can be “converted” into bi- or multilateral projects as long they are not implemented. CERs from unilateral projects can be sold via ERPAs until the CERs will be issued for the final time and via DPAs from the first issuance onwards.

Search activity costs are defined as the costs that directly accrue from the search process. They will usually arise in form of marketing costs, brokers' fees, charges for information services and communication costs (see Dudek/Wiener 1996, p. 20). They are typical search costs in the sense of neo-institutional economics. One can distinguish between external and internal search activity costs (see DEA 2003, p. 2-2). The former costs will accrue once a broker is used to market the potential project/CERs. The latter costs accrue once the project supplier/seller markets the potential project/CERs himself. Search activity costs can be assumed to highly depend on the institutional project design for the following reasons. In the case of unilateral projects the external costs will depend on the total emission reductions of the project. The ex-post emission reductions determine the volume of CERs to be sold and brokerage fees in the GHG market usually depend on the volume traded (see Rosenzweig et al. 2002, p. 19). Second, they depend on maturity, size and level of standardisation of the market all of which can be assumed to be interdependent. As the first commitment period gets closer more supply and demand will presumably enter the CER market. In turn this can be expected to increase the number of brokers, trading platforms and information exchanges (see Ellerman et al. 2003, p. 22). This can be guessed to eventually reduce the external search activity costs for sellers.

Currently, some brokers are also active in matching potential CDM project partners for bi- and multilateral projects (see Rosenzweig et al. 2003, p. 19). Information on which factors matchmaking fees depend on is not available.

Internal search activity costs can be assumed to depend on a number of factors among which will most likely be the available formal and informal information network from which information on potential buyers/investors can be obtained as well as the specific search strategy.

Potential buyers willing to engage in ERPAs require the project suppliers to submit a documentation on the CDM project before a decision for a LoI is made. It can be assumed that project suppliers that search for a potential investor will be required to supply similar documentation to the potential investor.

The minimum documentation asked for is generally a Project Idea Note (PIN) and a Letter of Endorsement (LoE) from the host countries government (see Senter 2001, p. 16f., see PCF 2002a; see MoFA 2003b, p. 8f.). Some buyers also require more detailed information than provided in the PIN. For example the PCF additional to the PIN also demands a Project Concept Note (PCN). On top of that some buyers may also require

additional documentation to PIN, PCN and LoE (see Senter 2001, p. 17; see PCF 2003b). Therefore, project documentation costs are subdivided into the different types of documentation that might be required by the investor/buyer before a LoI is signed. This is illustrated further below.

Project documentation costs can be assumed to depend on two factors. First, the documentation requirements of the investor/buyer. Second, on the institutional project design as it can be assumed that the need for documentation will be less in the case of unilateral projects than in the case of bi- and multilateral projects for the following reason. It can be assumed that documentation will not be required for a DPA anymore because the CERs are already issued. Consequently, the buyer does not need to make sure that the project is registered, implemented and will eventually generate CERs. An ERPA can be assumed to require more documentation if the project has not been registered than in a case when it has been registered and CERs have already been issued. One could assume project documentation required to be highest in case of a potential bi- or multilateral project as direct investment is involved.

PIN Costs

The PIN is a document which usually contains general information on the project (e.g. projects status, participants, project type, lifetime and finance) and a brief description of the likely baseline scenario of the project and the expected GHG emission reductions (see Senter 2001, p. 20ff; see PCF 2002a; see MoFA 2003b, 31ff.). PIN costs are defined as the costs that arise during the preparation of the PIN. They will usually come in the form of costs for time and resources spend for information gathering and its' documentation.

PCN (or similar) Costs

After approval of the PIN the PCF requires a preliminary baseline study and a description of the projects socio-economic and environmental impacts as well as a detailed financial analysis in a so called Project Concept Note (PCN) (see PCF 2003b). It is also conceivable that other investors/buyers might require a more advanced project note after they have received the PIN. PCN (or similar) costs are therefore defined as the costs that accrue for the preparation of an advanced project note (e.g. a PCN).

LoE Costs

The LoE is a document in which a host country without an official DNA endorses the project⁵⁸. Endorsement means that it agrees in principal to give host country approval to the project as required in the CDM rules once the DNA is in place and once it obtains the information it requires for the approval process⁵⁹ (see PCF 2002b).

LoE costs are defined as the costs that the project supplier/seller faces in order to receive host country endorsement. Such costs can be expected to come in the form of costs for meetings and presentations at the governmental body which has endorsement authority. LoE costs can be assumed to depend on the specific situation in the host country. First, they do not arise once the host country has set-up a DNA. Second, they can be assumed to be highly sensitive to the length of the approval process as well as transparent rules and procedures (see Deodhar et al. 2003, p. 15f.).

Additional Documentation Costs

Additional documentation costs are defined as those costs that arise from preparation of documentation additional to PIN, PCN (or similar) and LoE. For example PCF also requires environmental, social legal and financial due diligence to be carried out (see PCF 2003b). Senter required the baseline of the project to be validated before signing the LoI (see Senter 2001, p. 17).

4.4.1.1.1.3 LoI Costs

LoI costs are defined as the costs that accrue to the project supplier/seller during the negotiation of a Letter of Intent (LoI). Evidence from the forward CER market tells that a LoI is used between the seller and the potential buyer to express their mutual interest in exchanging the CERs via an ERPA. The LoI stipulates that the buyer has the exclusive right to negotiate an ERPA for the CERs from the concerned project at the price and quantity agreed for in the LoI (see PCF 2002b).

It can be cautiously concluded that LoIs represent a risk minimisation vehicle for the buyer. For example the PCF engages in LoIs before the potential CDM projects are registered by the EB but it proposes to start negotiating the ERPAs only after the respective project has been registered (see PCF 2003b). It is conceivable that LoIs with

⁵⁸ At the time of writing only 17 potential host countries had reported a DNA to the UNFCCC (see UNFCCC 2003c).

⁵⁹ The host country endorsement process will give both the potential project supplier/seller and the potential investor/buyer an early indication if the project is likely to gain host country approval once the DNA is in place. As LoEs are currently required by potential buyers before they enter into a LoI they can be interpreted as a requirement which lowers the risk of stranded expenses for project evaluation in the case of non-approval of the project by the DNA.

a similar purpose might also be signed between the project supplier and the project investor in a potential CDM project in order to lay down the principles of a potential future co-operation. For example the LoI may stipulate that the investor only agrees to invest in the project once the project is registered.

It is assumed here that LoIs will not be required for a DPA as the CERs have been issued already and the parties to the exchange will directly negotiate upon the details of the trade. It can be assumed that if the LoI is signed for an ERPA this will involve lower costs than in the case of a potential project co-operation as the latter might involve the review of considerable amounts of documentation received from the potential investor as direct investments are involved.

4.4.1.1.2 Costs for Finding a Potential Project Supplier/Seller

These costs are defined as the costs that accrue to the potential investor/buyer until he and a potential project supplier/seller have expressed their mutual interest in a Letter of Intent (LoI) to jointly develop a CDM project or to exchange CERs. They are subdivided into costs that accrue from the search activity of the potential investor/buyer (Search activity costs), costs that arise from the preparation of documentation on the potential investor/buyer (Investor/buyer documentation costs) and the costs that arise once the potential investor/buyer decides on and negotiates a LoI with the project supplier/seller (LoI costs).

The same characteristics apply to the search activity costs and LoI costs incurred by the potential investor/buyer as outlined in section 4.4.1.1.1.1 and section 4.4.1.1.1.3 respectively in the case of the project supplier/seller.

It is assumed that investor/buyer documentation costs accrue because the project supplier/seller might require information from the investor/buyer that he deems relevant in order to decide if he wants to engage in a LoI or not. This could for example be a documentation on the credibility of the investor/buyer.

It is conceivable that such costs depend on the project design as it can be guessed that documentation required by a potential project supplier for a project co-operation might be more detailed than if the parties engage in an ERPA. In the case of a DPA they might not be required at all if the CERs are exchanged upon payment by the buyer.

4.4.1.2 Negotiation Costs

For the purpose of this study negotiation costs in the context of bi- and multilateral projects are defined as the costs that arise when project suppliers and potential investors negotiate the details of their future co-operation in a CDM project on the basis of the LoI. In case of unilateral projects negotiation costs are defined as the costs that arise

when potential sellers and buyers negotiate the terms of the ERPA or DPA on the basis of the LoI.

Negotiation costs will arise in form of time spent to conclude the negotiations, communication and travel costs and possibly a fee for specialised consultants in legal or financial matters (see Dudek and Wiener 1996, p. 20).

Negotiation costs can be assumed to depend on the institutional project design. If a bi- and multilateral project co-operation is negotiated the project partners will usually discuss the detailed project design, the financing of the project, the obligations of each participant, the sharing of costs and revenues and any other issues relevant for project development (see *ibid*, p. 20). In addition, they will decide on the sharing of CERs that will arise from the project activity. The outcome will usually be put into a legal format. Hence, legal counsel might be sought as well (see *ibid*, p. 20).

The potential seller and buyer will either negotiate an ERPA or a DPA. Experience shows that an ERPA usually stipulates the obligations of the parties (e.g. the liability clauses, terms of delivery, price and terms of payments (see PCF 2002b; see IETA 2002, p. 5ff.)). It can be assumed that once CERs are traded via a DPA the parties to the exchange simply need to agree on quantity and price and sign a sale contract.

It can be expected that negotiation costs depend on the maturity of the market. For example electronic trading platforms or brokers might facilitate trading of CERs on spot, future or option markets which eliminate the need for direct negotiations between buyer and seller. Instead they would simply need to pay a utilisation fee for an electronic trading platform or a brokerage fee⁶⁰. It can be guessed that such a level of standardisation will not be possible for potential CDM project co-operations as face-to-face negotiations will be required once direct investments are planned.

4.4.2 *Pre-Implementation Transaction Costs*

The pre-implementation transaction costs encompass the costs that accrue from the CDM project cycle until the project is formally registered as a CDM project.

4.4.2.1 *PDD Costs*

In this study PDD costs are defined as those costs that accrue from the tasks that have to be undertaken in order to complete the PDD.

⁶⁰ The service delivered for such a fee might also incorporate search activity on behalf of the seller. It is conceivable that eventually the seller will only pay a single fee to the broker for which the broker in turn facilitates an ERPA or DPA without any additional involvement of the seller. In such a case the seller will not face any other market transaction costs besides the fee paid to the broker. Costs for searching for the broker are neglected in this example.

4.4.2.1.1 Baseline Costs

These costs are defined as the costs that accrue from the determination of the baseline methodology and/or the baseline⁶¹. As described, the baseline represents a counterfactual situation and is based on a number of assumptions, measurements or simulations. Choosing a combination of approach, methodology and project baseline cannot be assumed to be a straightforward task because the project developers can be guessed to look for a combination that allows them for the following. A minimisation of the baseline costs while at the same time ensuring a maximum output of CERs, approval of the baseline methodology if still required, as well as validation of the baseline by the OE.

Baseline costs will usually come in form of costs for time and resources spend for data gathering, analysis, processing and documentation both of the project and the projects' environment (energy policies, economic development, etc). Experience has shown that usually external consultants are hired to guide and assist in the determination of the baseline (methodology) (see PWC 2000, p. 13). In such a case costs will also arise in form of consultancy fees.

It is assumed that baseline costs depend on the complexity of the project and its' baseline assumptions (see *ibid*, p. 19; DEA 2003, p. 2-1). This seems reasonable as it can be assumed that the more variables exist that influence the baseline the more data needs to be gathered, analysed, processed and documented. For example it can be estimated that *ceteris paribus* baseline costs for a wind power project are lower than for a methane capture project from municipal solid waste (MSW) with electricity generation. The latter project consists of two components that lead to a reduction of GHG emissions and will be accounted for in the baseline (captured methane emissions and supply of electricity generated with the captured gas to the grid) (see PCF 2003c, p. 14). The former project of one component (electricity output) (see EcoSecurites 2003, p. 8).

If the project developer has chosen an initial crediting period of 7 years he can renew it at most two times. A precondition for renewal is that a OE determines that the baseline is still valid or has been adjusted taking into account new data. In either case costs will accrue for the project developer in form of gathering, analysing, processing and documenting data that influence the baseline. A fee to the OE is to be paid for re-validation. Therefore, baseline costs will also depend on the choice of the crediting period.

⁶¹ Costs for the baseline methodology will only accrue if a new baseline methodology needs to be submitted to the EB for approval.

Finally, it can be assumed that baseline costs depend on whether a baseline methodology has been approved for a specific project category already or not. In the former case the costs can be guessed to be lower as the methodology is readily available and does not need to be set-up and approved.

4.4.2.1.2 Monitoring Plan Costs

These costs are defined as the costs that accrue to the project developer when he determines the monitoring methodology and/or the monitoring plan⁶². Monitoring plan costs will usually come in form of time and resources spent for data gathering, analysis, processing and documentation. As the monitoring plan is closely linked with the baseline a consultancy will usually assist in the setting-up of the monitoring methodology and/or plan so that costs can also come in the form of consultancy fees. It can be assumed that this sub-cost component does depend on the project complexity for the same reasons as outlined in the case of baseline costs.

4.4.2.1.3 Environmental Impact Documentation Costs

These costs are defined as the costs that arise for the assessment of the environmental impacts of the proposed CDM project and its documentation. Environmental impact documentation (EID) costs will accrue to the project developer in form of time and resources spent for on-site visits, data gathering and documentation. However, if the project is regarded to have significant environmental impacts the costs may also include fees for specialised consultants for EIAs. The costs for the EIA can be expected to depend strongly on the procedures of the host country for EIAs. It can be assumed that EID costs will depend on both project type and project size⁶³. The project type will determine the emission level of local pollutants whereas the project size will e.g. determine the level of visual impact.

4.4.2.1.4 Stakeholder Consultation Costs

The stakeholder consultation costs are defined as the costs that arise during the process of seeking stakeholder comments as well as the documentation on the summary of the comments and on how the project developer took due account of the comments received. The costs will usually come in form of time and resources spent for on-site visits, meetings and communication. Additional costs might arise once the project

⁶² Costs for the monitoring methodology will only accrue if a new monitoring methodology needs to be approved by the EB

⁶³ Project size in this context refers to the physical characteristics of the project such as level of occupation of area, height of the installation, etc that have an impact on the local environment.

developer has to negotiate with the stakeholders on the project design in order to take due account of their comments.

The costs can be guessed to depend on both project type and size. Presumably the number of stakeholders and their level of engagement in the stakeholder comments process will increase the larger the project⁶⁴ or the more local pollutants or other negative effects the project might cause.

4.4.2.1.5 Other PDD Costs

There will be other costs that arise from the preparation of the PDD additional to the ones described above. Other PDD costs encompass documentation costs for the general description of the project and the calculation of GHG emissions of the project over the crediting period as required in the PDD.

4.4.2.2 Approval Costs

Approval costs are defined as the costs that the project developer faces in order to receive host country approval. Such costs will usually come in form of costs for meetings and presentations at the DNA. It is also conceivable that the DNA might want to charge an approval fee (see Deodhar et al. 2003, p. 15). Approval costs can be assumed to depend on the specific situation in the host country as they are highly sensitive to the length of the approval process, transparent rules and procedures as well as clear approval criteria⁶⁵ (see *ibid*, p.15ff.).

4.4.2.3 Validation Costs

Validation costs are defined as the costs that the project developer has to pay to the validator for checking if the project meets the validation requirements. Validation costs will usually arise in form of a fee paid to the validator.

Validation costs are expected to vary with a projects' complexity and baseline assumptions (see PWC 2000, p. 13; see DEA 2003, p. 2-2). This seems reasonable when considering that the effort required for validation will e.g. depend on the number of variables that determine the baseline.

⁶⁴ See footnote above.

⁶⁵ As it is prerogative of the host country to confirm if a potential CDM project assists the country in achieving sustainable development the host country will ideally have developed national criteria and established national procedures for the evaluation and approval of projects by the DNA (see Castro/Figueroa 2002, p. 63ff.).

4.4.2.4 Registration Costs

Registration costs are defined as the costs that the project developer has to pay to the EB for registration of the project as long as the COP has not decided on an administration fee for CDM projects. The EB charges the registration fee based on the anticipated emission reduction as given in the PDD. The fee will be deducted in form of CERs upon issuance⁶⁶. Which registration fee applies to which emission reduction is shown in table 5. Thus the registration costs rise and fall with the anticipated emission reduction.

Table 5: Registration Fee for CDM Projects

Anticipated ER in t CO ₂ e/a over the Crediting Period	\$US
≤ 15,000	5,000
> 15,000 and ≤ 50,000	10,000
> 50,000 and ≤ 100,000	15,000
> 100,000 and ≤ 200,000	20,000
> 200,000	30,000

Source: see UNFCCC (2003d), p. 10

4.4.3 Implementation Transaction Costs

The implementation transaction costs encompass all costs that accrue from the tasks to be performed in the project cycle from the implementation of the CDM project up to the end of the (last) crediting period.

4.4.3.1 Monitoring Costs

Monitoring costs are defined as the costs that arise from the implementation of the monitoring plan, the periodic monitoring activities and the periodic submission of the monitoring report⁶⁷.

Monitoring costs can be sub-divided into initial and periodic costs. The former will arise from the purchase and installation of monitoring equipment as well as data

⁶⁶ It is not yet clear how the value of each CER at the time of issuance will be determined.

⁶⁷ Please note that in order to be a transaction cost component these have to be additional to conventional project monitoring costs. For example in the case of an electricity generation project the measurement of electricity output if required by the grid operator should not be accounted for as transaction costs of CDM projects.

processing and archiving equipment that allows for monitoring, processing and archiving of data as required in the monitoring plan. The latter costs accrue periodically. Costs for the monitoring report for compilation of the data also arise periodically. As the monitoring report is the basis for verification and certification it depends on the preferences of the project developer how frequently the costs for the monitoring report will accrue. If the project developer for example decides to get his emission reductions verified and certified bi-annually these costs will accrue in the same intervals. PWC (2000) assumes monitoring costs to vary slightly with project complexity (see PWC 2000, p. 13). This assumption seems to be reasonable for the same reasons as outlined in the case of baseline costs. The periodic monitoring costs can also be assumed to depend on the choice of the crediting period because the longer the project period the more costs will accrue for monitoring and documentation. The magnitude of total periodic monitoring costs over the crediting period will mainly depend on the frequency with which the monitoring report is established (see de Gouvello and Coto 2003, p. 13ff.).

4.4.3.2 Verification and Certification Costs

Verification and certification (V+C) costs are defined as the costs that the project developer has to pay to the verifier. V+C costs are considered as a single transaction cost component because the project developer will usually pay a single fee to the verifier for both verification and certification (see de Gouvello/Coto 2003, p. 19).

PWC (2000) assumes V+C costs to depend on the complexity of the project (see PWC 2000, p. 13). This line of reasoning seems realistic for the reasons outlined in the case of the validation costs.

As it is the case with the monitoring costs the total V+C costs over a given crediting period will mainly be determined by the frequency with which V+C is undertaken (see de Gouvello and Coto 2003, p. 13ff.).

4.4.3.3 Adaptation Fee

Before issuance 2% of the CERs have to be transferred to the adaptation fund. The total costs of the adaptation fee will depend on two factors. First, the total quantity of emission reductions achieved until the end of the (last) crediting period. Second, on the value of the CERs at the time of issuance⁶⁸. The costs will accrue periodically depending on the intervals the CERs are issued. Projects in least developed countries are exempted from the fee. Therefore, the costs also depend on the host country.

⁶⁸ The value could for example be the price agreed upon in an ERPA or the current market price for CERs at the time of issuance.

4.4.3.4 Administration Costs

As described the COP will decide on a percentage from the CERs to be retained by the EB for its' administrative expenses in the future. In that case the administration costs are defined as the costs that accrue to the project developer from the percentage of CERs retained. They depend on the same factors as the costs from the adaptation fee. As long as this percentage is not determined by the COP the registration fee will be charged instead.

4.4.4 Transaction Costs of Small-Scale CDM Projects

It has been argued by a number of authors that small-scale projects will not be attractive under the CDM due to the large transaction cost burden (see *inter alia* Bosi 2001, p. 8ff.; Walsh (2001), p. 4 and Michaelowa/Stronzik 2002, p. 25ff.). As a response the EB adopted the simplified CDM rules for small-scale CDM projects⁶⁹ (see UNFCCC 2003e).

Eligible for using the SSC rules are projects that fall under the three categories below:

- (a) Renewable energy projects with a maximum capacity of 15 MW.
- (b) Energy efficiency projects which reduce energy consumption by up to 15 GWh/a.
- (c) Other projects that reduce GHG emissions and directly emit less than 15 kt of CO₂e annually.

This section briefly illustrates the mayor amendments that have been made to the CDM rules in order to reduce transaction costs of SSC projects and which cost components can be assumed to be lower once projects are eligible under SSC rules.

Baseline costs can be estimated to be lower for SSC projects for a number of reasons. The projects will automatically qualify for so called standardised indicative baseline methodologies already defined by the EB according to their project category. The SSC rules also include recommendations on which type of data should be used for calculation of the baseline⁷⁰. Project developers do not need to submit baseline methodologies to the EB and do not need to derive the baseline by applying the baseline methodology in the context of the project⁷¹. Hence, the calculation of the baseline will

⁶⁹ In the following projects that are eligible under the simplified CDM rules will be abbreviated "SSC CDM projects".

⁷⁰ They are available for 13 project categories (see UNFCCC 2003e).

⁷¹ Except for cases, where a methodology for a new SSC project category needs to be submitted to the EB for approval.

presumably require a lot less effort. It is possible that external consultants will not be needed anymore for baseline and monitoring plan determination if the indicative baselines and the included recommendations should prove self-explanatory.

Monitoring plan costs are also likely to be lower because the SSC rules also include indicative simplified monitoring methodologies. They also provide recommendations on which type of data should be monitored and therefore be included in the monitoring plan.

EID costs can be estimated to be significantly lower for SSC projects because the SSC rules do only require a documentation on analysis of the environmental impacts of the project activity if required by the host country. Therefore, the costs will strongly depend on the specific situation in the host country.

It was assumed that the **Stakeholder consultation costs** depend on both project type and size as presumably the number of stakeholders and their level of engagement in the stakeholder comments process will increase the more local pollutants the project might cause or the larger the project⁷². Consequently, it can be estimated that stakeholder consultation costs will be lower with SSC projects simply because their impact on the stakeholders will be lower due to their smaller size.

V+C costs can be assumed to be significantly lower for SSC projects because the same OE that performed validation is also allowed to carry out V+C. The cost savings will be realised because the OE already knows the project well and consequently it will require less time and resources for verification and certification (see PWC 2000, p. 16).

Finally, two things should be noted. First, the registration costs and costs that arise from the adaptation fee will be lower for SSC projects simply because the projects will have smaller emission reductions than non-SSC projects. The SSC rules itself have no impact on these components. Above it has been assumed that validation and monitoring costs will simply depend on the complexity of the project. For this reason it is suspected that the SSC rules do not affect the validation and monitoring costs.

4.5 First Estimates for Transaction Costs of CDM Projects and Their Impacts on the Viability of CDM Projects

A number of studies estimate the magnitude of transaction costs of non-SSC CDM projects. Usually, the estimates are based on experiences gained by CDM consultants,

⁷² Project size in this context refers to the physical characteristics of the project such as level of occupation of area, height of the installation, etc. that have an impact on the local environment.

PCF and Senter from the interaction with project developers (see EcoSecurities 2002, p. 19ff.; see DEA 2002, p. 2-1f.; see Michaelowa/Stronzik 2002, p. 15ff.).

Table 6 gives an overview of the estimates collected during the review of the studies. When different cost estimates were found they are presented in form of cost ranges from the lowest to the highest value. Values depending on the quantity of emission reductions of the project are put in italic.

Table 6 gives a first idea of the magnitude of absolute transaction costs of potential non-SSC CDM projects. It can be observed that the cost estimates for some components vary significantly. When adding up the lowest (highest) absolute *search and negotiation costs* one obtains the *min. /max. MTACs* displayed. One obtains the *min./max. PITCs and ITCs I*⁷³ when adding up the lowest (highest) figures for the *PITCs and ITCs* cost components that do not depend on the projects' emission reduction. The resulting *min./max. TACs I* range from 160,000 - 715,000 \$US.

Michaelowa and Stronzik (2002) highlight that absolute transaction costs are not a sufficient indicator to determine the viability of a CDM project. Instead a projects' viability at a given CER market price is determined by the specific transaction costs plus the specific abatement costs of the underlying project (see Michaelowa/Stronzik 2002, p. 25).

Projects with negative abatement costs will not be eligible for the CDM because they violate the additionality criterion. Consequently, a potential CDM project in order to be viable needs to have abatement costs larger than zero and lower than the given CER price minus the project's transaction costs.

Empirical data on specific transaction costs is very scarce. Michaelowa and Stronzik (2002) have preliminarily quantified specific transaction costs for two CDM projects which have been contracted by the PCF (see Michaelowa/Stronzik 2002, p. 17). The findings are not presented here as they are based on a different definition of transaction cost components than the one used in this study (see section 4.3).

In order to highlight the impact of a project's total emission reduction on the specific transaction costs Michaelowa and Stronzik (2002) have applied absolute cost estimates to different project types and their generic range of emission reductions over a crediting period of ten years (see Michaelowa/Stronzik 2002, p. 25).

⁷³ The symbol "I" indicates that this is only a part of the total PITCs and ITCs because the registration costs and the costs arising from the adaptation fee have not been accounted for.

Those emission reduction ranges have been used in this study in order to calculate min. specific transaction costs on the basis of the min. transaction costs quantified in table 6⁷⁴. The results are displayed in table 7. They have been calculated as follows.

The *min. MTACs, PITCs and ITCs* are taken from table 6. It has been assumed that they accrue to all project types in the same magnitude. In order to calculate the *total min. PITCs and ITCs*, the *registration costs* and the costs accruing from the *adaptation fee* have been added. As these depend on the total emission reduction they have been calculated for each project type and its' generic emission reduction separately.

Registration costs were taken from table 5. The costs arising from the *adaptation fee* have been calculated by multiplying the total amount of emission reduction with the adaptation fee of 2%. The resulting value is the amount of CERs that will be deducted until the end of the crediting period. The value has been multiplied with an assumed CER price of 3.78 \$US⁷⁵. The resulting figure represents the total loss in CER revenue due to the adaptation fee⁷⁶. Specific transaction costs have been calculated by dividing the absolute cost figures by the anticipated total emission reduction.

⁷⁴ The figures from Michaelowa and Stronzik (2002) are not quoted in this study as their definition of transaction costs is different to that used in this study and as they do not account for all cost components defined in this study.

⁷⁵ The assumed price represents the modelled permit price in the international GHG market under the Kyoto Protocol for the first commitment period as given in section 3.4.2.

⁷⁶ Please note that during this exercise the costs have not been discounted to the NPV. The reason is that estimation on when costs will accrue would be arbitrary (e.g. in which intervals V+C will take place).

Table 6: Estimates for Absolute Transaction Costs of Potential Non-SSC CDM Projects by Cost Component

TACs		\$US ¹⁾ (% of CERs)	
MTACs	Search Costs	18,000	3-15% of CERs ³⁾
	Negotiation Costs ²⁾	29, - 471,000	
PITCs	Baseline Costs	20, - 25,000	
	Monitoring Plan Costs	8, - 18,000	
	Approval Costs	47,000	
	Validation Costs	6, - 34,000	
	Registration Costs	5, - 30,000	
ITCs	Monitoring Costs	12,000	
	V+C Costs	4, - 18,000 per turn	
	Adaptation Costs	2% of CERs	
Min./Max. MTACs ⁴⁾		47,000	489,000
Min./Max. PITCs + ITCs I ⁵⁾		113,000	226,000
Min./Max. TACs I		160,000	715,000

1) Cost estimates were available in € and £. The converted costs in \$US have been rounded off to the nearest multiple of 1000.

2) Besides the definition used in this study, the absolute negotiation cost range given by Michaelowa and Stronzik (2002) also factors in all costs for PDD development which are additional to the baseline and monitoring plan development.

3) EcoSecurities (2002) and DEA (2002) assume that the search for a buyer respectively seller will take place via a broker that will charge a percentage of the CERs generated for facilitating the CER trade. If the figures also factor in negotiation on behalf of the buyer/seller as described in section 4.5.1.1.1.1 is not known but conceivable.

4) Only the absolute figures are considered.

5) Only including such cost components that do not depend on the emission reduction of the project and assuming a crediting period of ten years and bi-annual V+C (V+C costs are 20,000 \$US respectively 90,000 \$US).

Source: see Michaelowa/Stronzik (2002), p. 24; see EcoSecurities (2002), p. 21; see DEA (2002), p. 2-1f.

Table 7: Dependence of Specific Transaction Costs of CDM Projects on the Total Emission Reduction

TACs	Total Emission Reduction over Crediting Period of 10 Years (Typical Project Type)									
	5,000,000 t CO ₂ e ("very large") (e.g. large hydro power, landfill methane capture, etc)		1,000,000 t CO ₂ e ("large") (e.g. wind power park, large industrial energy- efficiency projects, etc)		100,000 t CO ₂ e ("small") (e.g. small hydro, small industrial boiler conversion, etc)		10,000 t CO ₂ e ("mini") (e.g. energy efficiency in households or SMEs, mini hydro, etc)		1,000 t CO ₂ e ("micro") (e.g. PV)	
	\$US	\$US/t CO ₂	\$US	\$US/t CO ₂	\$US	\$US/t CO ₂	\$US	\$US/t CO ₂	\$US	\$US/t CO ₂
Min. MTACs	47,000	0.009	47,000	0.047	47,000	0.47	47,000	4.70	47,000	47.0
Min. PITCs + ITCs	568,000	0.114	250,600	0.251	172,560	1.73	165,756	16.58	165,076	165.1
Min. PITCs + ITCs I	160,000	0.032	160,000	0.160	160,000	1.60	160,000	16.00	160,000	160.0
Registration Costs	30,000	0.006	15,000	0.015	5,000	0.05	5,000	0.50	5,000	5.0
Adaptation Fee	378,000	0.076	75,600	0.076	7,560	0.08	756	0.08	75.6	0.1
Min. TACs	615,000	0.123	297,600	0.298	219,560	2.20	212,756	21.28	212,076	212.1

Source: see Michaelowa/Stronzik (2002), p. 24; see EcoSecurities (2002), p. 21; see DEA (2002), p. 2-1f. and own calculations

On the basis of this preliminary estimation of specific transaction costs in table 7 it can be observed that min. specific transaction costs range from 0.12 \$US/t CO₂ for “very large” projects to 212 \$US/t CO₂ for “micro” projects.

It can be seen that this is mainly due to economics of scale in terms of total emission reduction because except for the *registration costs* and costs arising from the *adaptation fee* all components are independent of the project’s total emission reduction and thus fixed costs. At a single given CER price the absolute costs for the *adaptation fee* are directly proportional to the emission reduction. Hence, all projects have equal specific costs arising from the *adaptation fee*. Although absolute *registration costs* are lower for projects with smaller emission reductions, they are higher when expressed specifically.

With maximum abatement costs of 3.66 - 3.48 \$US/t CO₂ and specific transaction costs of 0.12 - 0.30 \$US/t CO₂ “very large” and “large” projects would allow for such projects with maximum abatement costs of 3.66 - 3.48 \$US/t CO₂ to be viable at an assumed market price of 3.78 \$US/t CO₂. Abatement cost estimates in Non-Annex I countries suggest that there is a considerable mitigation potential for typical project types for “very large” and “large” projects in the range of CO₂ abatement costs between 0 - 3.66 \$US/t CO₂ and 0 - 3.48 \$US/t respectively (see Moomaw et al 2001, p. 260ff.). Therefore, it can be assumed that transaction costs will very likely not hinder development of “very large” and “large” CDM projects.

For “small” projects the transaction costs can be assumed to be critical. With transaction costs of 2.20 \$US/t CO₂ the projects would need to have abatement costs lower than 1.58 \$US/t CO₂ to be viable at an assumed market price of 3.78 \$US/t CO₂. Abatement cost estimates in Non-Annex I countries show that typical project types with a “small” emission reduction in most cases have abatement costs higher than 1.58 \$US/t CO₂ (see Moomaw et al 2001, p. 260ff.). For “mini” and “micro” projects the transaction costs can be assumed to be a considerable barrier. They will not be viable as the specific transaction costs exceed the CER market price by far.

How far SSC rules will reduce transaction costs and make SSC projects more attractive under CDM is uncertain. De Gouvello and Coto (2003) have shown that absolute transaction costs for SSC projects can potentially be lower than the figures shown in table 6. For a potential SSC CDM micro hydro project they found that PDD costs were only around 3,000 \$US and the sum of both validation and V+C costs could potentially be reduced to 3,800 \$US over a crediting period of 21 years (see de Gouvello/Coto 2003, p 16ff.). However, they did not calculate specific transaction costs for the project. The discussion undertaken in this section gives rise to the following conclusions. First, specific transaction costs seem to be mainly determined by a project’s total emission

reduction due to economics of scale. Second, which amount of transaction costs make a potential CDM project unviable will depend on the abatement costs of the respective project as well as the CER price the project developer will achieve. Therefore, it can be generally concluded that the higher the emission reduction of the project the higher the probability that the transaction costs do not impact the project's viability.

When considering that usually projects with small emission reductions very likely have higher abatement costs than projects with high emission reductions, transaction costs will very likely impact the viability of small rather than large projects at current CER prices.

4.6 Summary of Transaction Costs of CDM Projects

Neo-institutional economics distinguish between market, political and corporate transaction costs of which only market transaction costs are considered in this study. When a commodity is traded market transaction costs increase the buyers' cost and/or lower the supplier's (net) price. Hence, less quantity is traded at a higher price than in the absence of transaction costs.

A general definition of transaction costs of CDM projects does not exist. For the purpose of this study they have been defined as costs that accrue from the tasks to be performed in the CDM project cycle until the end of the (last) crediting period as well as search and negotiation costs. The definition used does not claim to cover all potential costs.

In case of all Kyoto Mechanisms transaction costs result in a lower quantity of emission permits traded in the international GHG market under the Kyoto Protocol compared to a situation in which the price represents marginal abatement costs. The share of each type of permit in the overall quantity of all permits traded will besides its' abatement costs depend on its' transaction costs. Several authors estimate that transaction costs of the CDM will most likely be higher than for IET and JI.

On the basis of the definition of transaction costs of CDM projects used in this study a compilation of transaction cost components has been established. It was discussed which factors influence the cost components' magnitude and how the SSC rules lower the TACs for smaller projects. The findings of these discussions are displayed in table 8. They give rise to the following preliminary conclusions. MTACs can be estimated to mainly depend on the institutional project design and the maturity of the GHG market. However, they can be guessed to be very case-specific. The following factors MTACs depend on have not been included in table 8. Once CERs from unilateral projects are sold via ERPAs or DPAs with the assistance of brokers, transaction costs will very likely depend on the total amount of CERs to be transferred as well as their price.

Transaction costs also depend on the information network available and the requirements of the parties to the exchange of CERs/partners in the potential project co-operation.

Transaction costs accruing from the tasks to be performed in the project cycle can be guessed to depend on a variety of factors. All potential factors identified are shown in table 8. Absolute transaction costs of SSC projects *ceteris paribus* will most likely be lower for a number of cost components than for non-SSC projects. When considering the high number of factors transaction costs of CDM projects depend on it can be concluded that transaction costs are very project-specific.

Finally, it has been shown that the viability of a potential CDM project at given abatement costs and CER market price will be determined by the specific transaction costs. Preliminary calculations indicated that min. specific transaction costs range from 0.12 \$US/t CO₂ for “very large” CDM projects to 212 \$US/t CO₂ for “micro” projects. This high discrepancy is due to economics of scale in terms of the project’s total emission reduction as the majority of components is independent of the total emission reduction. On the basis of these calculations it can be concluded that at a CER price of 3.78 \$US transaction costs very likely represent a significant barrier for projects with low emissions reductions rather than for projects with high emission reductions. However, this will depend on the project’s abatement costs in each single case. A general statement cannot be made.

Table 8: Absolute Transaction Costs and Their Dependence on Selected Factors

TACs		Dependence on									Lower with SSC Projects
		Project Type/ Complexity	Project Size		Crediting Period Option	Host Country	Project Design	Frequency of V+C	Price of CERs	Time	
			Phy ₁₎	TER ₂₎							
MTACs	Search Costs										
	Costs for finding a pot. investor/buyer						X			X ³⁾	
	Costs for finding a pot. CDM project/CERs						X			X ³⁾	
	Negotiation Costs						X			X ³⁾	
PITCs	PDD Costs										
	Baseline Costs	X			X					X ⁴⁾	X
	Monitoring Plan Costs	X								X ⁴⁾	X
	EID Costs	X	X			X					X
	Stakeholder Consultation Costs	X	X								X
	Other PDD Costs										
	Approval Costs					X					
	Validation Costs	X									
	Registration Costs			X							X
ITCs	Monitoring Costs	X			X			X			
	V+C Costs	X			X			X			X
	Adaptation Fee			X	X				X		X
	Administration Costs			X	X				X		X

1) Physical size, 2) Total emission reduction (t CO₂e), 3) When assuming that over time the international GHG market will mature, 4) When assuming that over time more baseline and monitoring methodologies will be approved by the EB

Source: own table

4.7 Implications for Empirical Research Design

Empirical data on specific transaction costs of CDM projects is very scarce. Hence, the focus of empirical research on transaction costs should lie on the quantification of specific transaction costs in order to gain more knowledge on their impact on the cost-effectiveness of the CDM.

Empirical research needs to be designed in such a manner that it allows for the quantification of transaction costs on a project-specific basis as otherwise specific transaction costs cannot be calculated. In the following a proposal for an empirical research design that allows for this is briefly outlined.

Absolute transaction costs would need to be quantified on a project-specific basis. This could be done by quantifying the costs for each cost component defined in section 4.4. For each component which consists of further sub-cost components a transparent way of doing this would be to quantify the costs at the lowest level and to add them up (bottom-up approach). As the costs are not publicly available they need to be inquired from the persons that are involved in the development of the respective project. It is conceivable that such persons do not necessarily have to be the project developers themselves. As described, usually additional parties are involved in the development of the project (e.g. CDM consultants). Moreover, brokers might be contracted to match potential project suppliers/seller and investors/buyers and therefore might be a source for (parts of) MTACs for specific projects.

Cost figures do not need to be obtained for every cost component in order to quantify transaction costs. For example in order to quantify the costs accruing from the adaptation fee information on the project's total emission reduction and the CER price is sufficient. Table 9 gives an overview on which (sub-)cost components accrue to which party, which type of information or combination of information needs to be obtained to quantify the respective (sub-)cost component and which sources are potentially available to obtain such information. However, for some (sub-)cost components not all information given in table 9 needs to be obtained. In the case of MTACs the information needed will depend on factors like institutional project design as well as if consultants or brokers are involved.

For some projects CDM consultants may have developed the PDD and for some the project developers have completed it on their own. As the information required is very project-specific, information on the project itself needs to be inquired, too.

Once quantified the total absolute transaction costs are transferred into specific transaction costs.

In order to allow for a statement on the impact of transaction costs on the viability of each projects specific abatement costs as well as the CER price need to be inquired from the project developers.

The empirical research design proposed needs to allow for considerable interaction with the parties involved in the respective CDM project. Not the least because it can be expected that the definition of transaction cost components might need considerable explanation. Therefore, a survey among the parties involved in CDM project development is an appropriate means of facilitating the empirical research on transaction costs of CDM projects.

Table 9: Potential Sources of Information for Transaction Costs of CDM Projects

Transaction Costs		Party they accrue to	Types of Information	Sources of Information
MTACs	Search Costs	---	---	---
	Costs for finding a pot. investor/buyer	Pot. supplier/seller	Internal costs; fee; % of CERs + CER price	Pot. supplier/seller; CDM or legal consultant; broker
	Costs for finding a pot. supplier/seller	Pot. investor/buyer	s.a.	Pot. investor/buyer; CDM or legal consultant; broker
	Negotiation Costs	Pot. supplier/seller + investor/buyer	s.a.	See all above
PITCs	PDD Costs and sub-cost components	Project developer (PD) ¹⁾	Internal costs; fee	PD, CDM consultant
	Approval Costs	s.a.	s.a.	s.a.
	Validation Costs	s.a.	Fee	s.a.; OE
	Registration Costs	s.a.	ER	PD, CDM consultant
ITCs	Monitoring Costs	s.a.	Internal costs	s.a.
	V+C Costs	s.a.	Fee	s.a.; OE
	Adaptation Fee	s.a.	ER + CER price	PD, CDM consultant
1) The project developer can either be the project supplier and/or the investor or the seller of CERs.				

Source: own table

5 A Survey Among Players in CDM in India

A number of players are actively engaged in CDM through various avenues. In order to quantify transaction costs of potential CDM projects in India a number of these players have been shortlisted for participation in a survey conducted by the author. Section 5.1 gives a brief overview of the potential for CDM development and the state of CDM development in India before the survey was conducted. Section 5.2 presents the aim of the survey as well as the strategy used. Section 5.3 briefly outlines the participants that have been interviewed during a visit to India⁷⁷ in the first phase of the survey as well as the major questions raised. After returning from India a number of participants have been questioned in more detail in the second phase of the survey via electronic questionnaires. Section 5.4 gives a brief critique of the interviews and presents the aim of the questionnaires.

5.1 Information on CDM Potential and CDM Development in India before the Start of the Survey

The currently most comprehensive Indian GHG inventory is the ALGAS inventory⁷⁸. It estimates that the Indian energy sector in 1990 accounted for 56% (565 Mt CO₂e) of total GHG emissions⁷⁹ (see ADB et al. 1998, p. 5). The second largest emitter was the agricultural sector with a share of 34%⁸⁰ (341 Mt CO₂e). GHG emissions from the waste sector accounted for 7% (69 Mt CO₂e) and industrial processes for 2.5% (25 Mt CO₂e) of total national emissions. Net GHG emissions from the land-use change and forestry sector were almost negligible.

Until 2020 India is estimated to face a rapid increase in GHG emissions. It is expected to mainly take place in the energy sector due to increased consumption of fossil fuels. This sector is estimated to increase its CO₂ emissions fourfold up to a level of 2,308 Mt CO₂⁸¹ in 2020 under the BAU scenario (see ADB et al. 1998, p. 6). Compared to this

⁷⁷ One participant has been interviewed in Germany.

⁷⁸ The ALGAS (Asia Least Cost Greenhouse Gas Abatement Strategy) inventory has been established in 1998. It includes Indias' GHG emissions in 1990. It is still the most comprehensive inventory available. The national communication is currently under development and is expected to be finalised in November 2003 (see UNFCCC 2003f, p. 7).

⁷⁹ This includes fuel combustion and fugitive emissions from mining of fossil fuels. Not included are emissions resulting from biomass burning (see ADB et al. 1998, p. 5).

⁸⁰ This includes emissions from enteric fermentation in domestic animals, manure management, rice cultivation and burning of agricultural residues (see *ibid*, p. 5).

⁸¹ In 1990 CO₂ emissions accounted for 90% of the GHG emissions in CO₂e in the energy sector (see ADB et al. 1998, p. 5).

increase the predicted rise of CH₄ emissions in the agricultural sector by 22%⁸² from 12.5 – 16.0 Mt CH₄ in the same period is rather modest. GHG projections for other sectors are not available.

Shukla (2002) estimates the potential for GHG reduction projects in the Indian energy sector with abatement costs lower than 5.5 \$US to lie around 440 Mt CO₂e for the period from 2002 - 2012 (see Shukla 2002). The potential contribution of different mitigation options as well as their abatement costs are displayed in table 10.

Table 10: CO₂ Mitigation Potential in the Indian Energy Sector from 2002 to 2012

Mitigation Option	Mitigation Potential (2002-2010) (Mt CO ₂)	Long-term Marginal Costs (\$US/t of CO ₂)
Demand-side Energy Efficiency	165	0 – 4.0
Supply-side Energy Efficiency	117	0 – 3.5
Electricity Transmission & Distribution	44	1.5 – 8.0
Renewable Electricity Technologies	84	1.0 – 4.0
Fuel Switching: Coal to Gas	29	1.5 – 5.5
Total	440	0 – 5.5

Source: see Shukla (2002)

India gained its first experience in credit based trading in the AIJ pilot phase. The GoI had long opposed the concept of pre-Kyoto JI. When the AIJ pilot phase was introduced it changed its position and endorsed five AIJ projects. The learning experience for the CDM can be assumed to have been limited as of these only a single project has been implemented and reported to the UNFCCC⁸³ (see UNFCCC 2003g). In August 2002, the Indian Cabinet ratified the Kyoto Protocol. At COP8 which was hosted by India in October 2002 the prime minister declared that he would welcome the operationalisation of the CDM (see Vajpayee 2002). However, before the survey was conducted the GoI had not set-up a DNA. It was known that the Ministry of Environment and Forests (MoEF) would function as the interim nodal agency for giving host country endorsement to potential CDM projects. MoEF would operate in co-operation with the

⁸² In 1990, CH₄ emissions accounted for 84% of the GHG emissions in CO₂e in the agricultural sector (see *ibid*, p. 5).

⁸³ For a detailed account of the AIJ process in India see Chatterjee (1997).

ad hoc committee formed for approving AIJ projects that consists of representatives from various ministries (see Sharma 2003, p. 1). In September 2002, the MoEF published its interim approval criteria for CDM projects. They consist of a rough set of guidelines that project developers have to follow if they wanted to obtain a LoE (see MoEF 2002a). Before the start of the interviews the MoEF had endorsed 7 project proposals of which 6 tendered under CERUPT and 1 under the PCF (see MoEF 2002b). It was also known that MoEF had initiated the set-up of a CDM expert group consisting of both governmental and non-governmental representatives which would be in the process of drafting a cabinet decision for the set-up of the DNA.

Finally, it was known that a number of private sector companies and associations are engaged in CDM through various avenues. First, the big umbrella associations of the Indian industry such as the Confederation of Indian Industry (CII)⁸⁴ had organised workshops to inform their members about CDM and the business. Second, a number of consultancies that had been involved in climate policy related donor programmes have a good understanding of the CDM and are involved in CDM project development. Among those are the subsidiaries of the multi-national companies PriceWaterhouseCoopers (PWC), Winrock International India (WII), Louis&Berger (L&B), Ernst&Young (E&Y), a number of other small consultancies as well as Indian NGOs such as the The Energy and Resources Institute (TERI)⁸⁵ and Development Alternatives (DA). The Swiss consultant Factor was also known to be engaged in CDM. Third, the semi-public financial institution Infrastructure Development Financing Company (IDFC) was known to have negotiated a contract with the PCF to provide bankable projects from its pipeline to the PCF for CER purchase (see Narayanan 2003).

5.2 Aim of and Strategy for the Survey

The aim of the survey was first, to quantify transaction costs of CDM projects in India using the design proposed in section 4.7 of this study and second, to identify factors transaction costs might depend on. It was also considered important to analyse the framework for and players involved in CDM in India for two main reasons. First, to be able to account for peculiarities in CDM development that might influence the transaction costs of CDM projects in India. Second, to give an idea of the representativeness of the results found by considering the whole picture of CDM development in India.

⁸⁴ Among those were also the Associated Chambers of Commerce and Industry of India (ASSOCHAM) and the Federation of Indian Chamber of Commerce and Industry (FICCI).

⁸⁵ Formerly known as the Tata Energy Research Institute.

The survey was divided into two phases. The first phase consisted of 32 face-to-face interviews with players involved in CDM that were conducted during a five week research trip to India between March and April 2003. The second phase consisted of the exchange of information between the author and selected players via electronic questionnaires between July and August 2003.

5.3 Participants in the Survey and Major Questions in the Interviews

The players that participated in the survey can be divided into the following groups: project developers, CDM consultants, financial institutions and government representatives. Reasons for including the financial institutions and government representatives were the following. Some Indian financial institutions are providing finance for a number of potential CDM projects and are therefore involved in the development of the projects. Government representatives comprise senior officials of the central administration that are or have been involved in the CDM operationalisation process in India. They have a good knowledge of the CDM activities in the country. Potential buyers, brokers and DOEs have not been among the participants.

The major questions that were raised to each group during the interviews are displayed in appendix II. In total 15 interviewees provided valuable information for the aim of the survey. Each interviewees' belonging to the four above groups as well as the reference for each interview is displayed in appendix III.

5.4 Brief Critique of the Interviews

The information gathered during the interviews did not allow for a project-specific quantification of transaction costs of CDM projects as it was in most cases of a very general nature. Concerning question 1 (Q1) the interviewees in most of the cases were only prepared to give very broad information on the project types of their CDM projects without revealing too much of project details. From Q2 the author usually received general quantitative estimates of certain transaction cost components of CDM projects. Usually, the definition of transaction costs of CDM projects and the compilation of its' components needed considerable explanation. Concerning the low response on Q1 and Q2 the interviewees explained that the projects that they were involved in were at a very early stage of development. Consequently, responses on Q3 and Q4 were low as well. It was agreed with eight interviewees that the author would obtain more information via e-mail. In order to facilitate a standardised questioning via e-mail electronic questionnaires were designed by the author. It was the aim of the questionnaires to obtain project-specific cost figures for all transaction cost components for all projects

the recipient was known to be involved in. The participants were also requested to provide the abatement costs of the projects.

A blank sample questionnaire is displayed in appendix IV⁸⁶. 4 out of 8 questionnaires had returned until mid August 2003. In the course of this study information contained in the questionnaires will be referred to on the basis of the interview reference code of the respective participant as shown in appendix III.

⁸⁶ It will be explained in more detail in section 7.1.

6 Current Situation of CDM Project Development in India

A considerable number of potential CDM projects are currently being developed in India. Section 6.1 gives an overview on the potential CDM projects that the author found to be developed in India. Subsequently, section 6.2 provides an overview of the major players involved and their approach to engagement in CDM.

6.1 Current Status

During the survey information on around 65 potential Indian CDM projects that are in various stages of development was obtained. All projects are unilateral projects. 21 projects for which information on the project details were available are listed in table 11 and ordered according to their stage in the project cycle⁸⁷.

9 projects are eligible for the SSC rules. The PDD is known to have been completed for 9 projects. 12 projects received a LoE. None of the projects has received host country approval. This is because an Indian DNA had not been set-up at the time of writing. It is expected to be operational at the end of 2003 (see IRC03, see IRC04; see IRC08). For 5 of the projects the PDD was submitted to the EB for approval of the baseline and monitoring methodology. For one project they have been submitted in April 2003 but they were rejected at the 7th meeting of the EB in June. For the other four projects they have been submitted in September 2003. Their status is pending.

For 11 of the projects contained in table 11 the project developers are known to have signed LoIs with potential buyers for the CERs they will eventually generate. From these 5 have been signed under CERUPT, 5 have been signed with PCF and 1 project developer has engaged in a LoI with the GoF. However, for none of the projects an ERPA had been signed at the time of writing.

⁸⁷ Those projects for which transaction costs have been quantified are displayed in bold letters. Due to reasons of confidentiality their total emission reduction over the crediting period is not given.

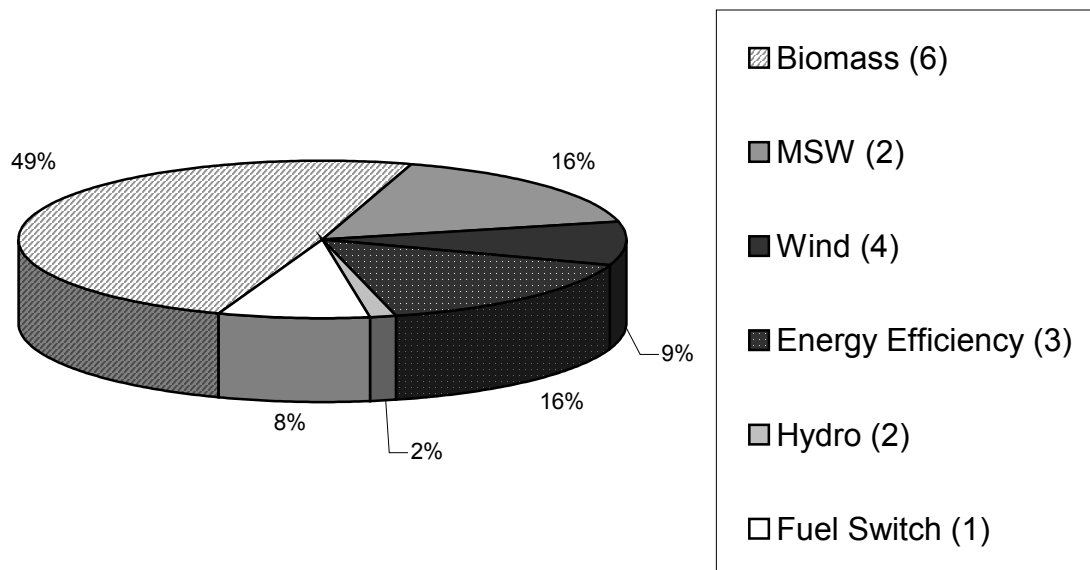
Table 11: Overview on Potential CDM Projects in India

Project Type	CERs over Crediting Period of 10 Years (t CO ₂ e)	Eligible for SSC Rules	Project Stage (completed)	LoE	LoI
Biomass	700,000 ¹⁾		PDD	Yes	n.a.
MSW Treatment	---		PDD	Yes	Yes
Biomass	---		PDD	Yes	Yes
Wind	---	X	PDD	Yes	Yes
Biomass	---	X	PDD	Yes	Yes
Wind	---	X	PDD	Yes	Yes
MSW Treatment	---		PDD	Yes	Yes
Biomass	---		PDD	Yes	Yes
Energy Efficiency	---	X	PDD	No	No
Biomass	---	X	PCN	Yes	No
Hydro	---	X	PCN	No	No
Hydro	---	X	PCN	No	No
Wind	---		PCN	No	No
Wind	---		PCN	No	No
Fuel Switch	---		PCN	No	No
Energy Efficiency	---		PCN	No	Yes
Biomass	n.a.	X	PCN	No	Yes
Energy Efficiency	387,240 ¹⁾		PIN	No	No
Wind	n.a.		n.a.	Yes	Yes
Biomass	1,150,000		n.a.	Yes	Yes
Biomass	n.a.	X	n.a.	Yes	Yes
1) These projects have selected an initial crediting period of seven years. At it is uncertain if the baseline will still be valid after this period only the CERs assumed to be generated during the first crediting period have been given.					

If all projects in table 11 for which the anticipated amount of CERs generated was obtained were registered and implemented they would in total generate around 25 million CERs⁸⁸. The shares of the different project types are displayed in figure 9.

⁸⁸ This figure does not include CERs generated in the potential second and third crediting period for those two projects which have chosen an initial crediting period of 7 years.

Figure 8: Share in Total Anticipated Volume of CERs of Selected Potential CDM Projects in India by Project Type



Source: see appendix V

It can be observed that renewable energy projects dominate with 12 projects. Of those 6 are biomass projects which have the largest share with almost 50% of the total CERs potentially generated. However, second, third and fourth rank(s) the MSW projects, energy-efficiency projects and the fuel switch project with shares of 16%, 16% and 8% respectively. Those projects achieved much higher emission reductions per project than the hydro and wind projects as shown in table 12.

An explanation for the low emission reductions for hydro and wind projects might be that all hydro projects and half of the wind projects are SSC projects and therefore have an installed capacity of 15 MW or smaller.

Table 12: Anticipated Average Emission Reductions of Selected Potential CDM Projects in India by Project Type

Project Type (Number of Projects)	Av. Emission Reduction (t CO₂e) over Crediting Period
Biomass (6)	2,017,517
Wind (4)	567,258
MSW (2)	2,077,005
Energy-Efficiency (3)	1,320,227
Hydro (2)	195,000
Fuel Switch (1)	2,000,000
Total (18)	1,362,834

Source: see table 11

Additional to the projects listed in table 11 the author obtained information on around 35 other projects which are in different stages of development. They are not listed in table 11 because detailed information was not given by the participants in the survey.

6.2 Current Trends

All projects for which the author obtained information from are unilateral projects. The project developers are eager to engage in ERPAs with potential buyers. Figure 10 displays the players identified to be involved in CDM project development in India as well as potential buyers that are in contact with Indian project developers.

The survey showed that some players already have pre-existing links with potential buyers. On the basis of that observation one can distinguish between three main routes potential CDM projects are developed in India and potential CERs sold.

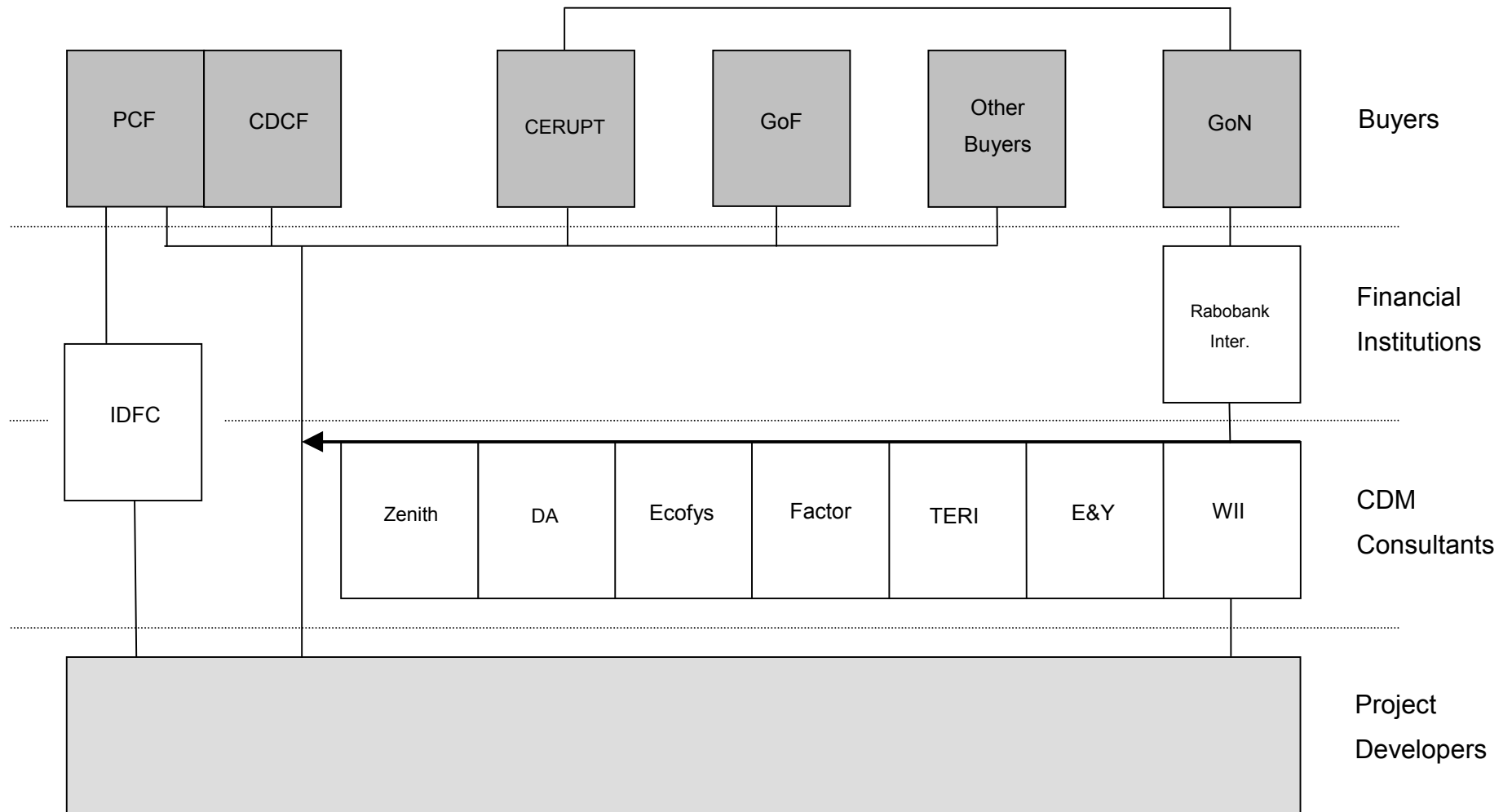
The first route observed is referred to as the **IDFC/PCF route**. At the center of this route is IDFC. In October 2002 it signed an agreement with the World Bank to supply CERs worth \$US 10 million from its project portfolio exclusively to the PCF. After having shortlisted a number of projects seeking finance from their portfolio IDFC is now assisting some of their clients which officially are the project developers in converting their projects into CDM projects. If requested, IDFC helps preparing the PIN, PCN and PDD and seeking host country approval. IDFC also negotiates the ERPA with the project developer on behalf of the PCF. Before project implementation IDFC carries out the project's due diligence on behalf of the PCF, seeks the PCFs' approval of PIN, PCN, PDD and ERPA and monitors and supervises the progress of the project.

Therefore, the role of IDFC in Indian CDM development can be described as an intermediary to match buyers and sellers of CERs. It carries out CDM consultancy services and finances CDM projects. It also provides quality assurance for both buyers and sellers. So far these services are provided exclusively to PCF and IDFCs' customers.

The second route observed is referred to as the **Rabobank/GoN route**. In March 2003, Rabobank International received a contract to supply 10 Mt CO₂e to the GoN and has teamed up with WII to set-up a project portfolio in order to generate CERs. Rabobank acts as an intermediary between the project developer and the GoN similar to the role of the IDFC in the IDFC/PCF route. However, Rabobank will not be involved in preparing the PDD. For this task Rabobank has sub-contracted WII.

The third route observed is referred to as the **PD/Buyer route**. In this route no financial intermediary with pre-existing links to a potential buyer is involved in the development of the project. The project developers need to find a buyer for their potential CERs on their own. They are usually assisted by CDM consultants in the preparation of documentation (e.g. PDD) and in seeking host country approval. Some CDM consultants also search for buyers on behalf of project developers.

Figure 9: Major Players in CDM in India



Source: own figure

7 Transaction Costs of Potential CDM Projects in India – A Preliminary Assessment of the Empirical Results Found

To start with the strategy used for the quantification of the transaction costs of the selected 15 projects is presented (7.1). A detailed description of the projects cannot be given due to reasons of confidentiality. Subsequently, the results are (7.2), the uncertainties involved in the results highlighted (7.3) and a preliminary assessment of the results found is carried out (7.4). Finally, a first discussion of the possible future development of transaction costs of CDM projects in India is undertaken (7.5).

7.1 Strategy for Quantification of Transaction Costs

The quantification of transaction costs was mainly undertaken on the basis of the questionnaires' results. As it was known from the interviews that only unilateral projects were being developed the questionnaire does not contain questions that refer to bi- or multilateral projects.

The participants were asked to quantify the absolute transaction costs for all cost components defined in section 4.4 (see appendix IV). Exemptions were **registration costs** and the costs accruing from the **adaptation fee**. In the **search costs** the sub-cost component *costs for finding a potential seller* were not included in the questionnaire as no buyers or brokers that could have provided such figures were among the participants in the survey.

Primarily, the participants were requested to provide cost figures that are based on the experience of the participant with a specific project. Alternatively, they were asked to estimate the costs if they felt they were in the position to do so. In case a project-specific quantification should not be possible they were also given the opportunity to provide average cost values for several projects. In some cases, cost figures obtained during the interviews were used for quantification.

LoE costs for projects which have not obtained a LoE are not considered. This is due to the fact that the Indian DNA can be expected to be set-up in the near future and that a LoE will not be needed anymore.

Concerning the **PDD costs** the following should be noted. First, for the purpose of quantification the sub-cost components *environmental impact documentation costs* and *stakeholder consultation costs* were merged in a single sub-cost component and renamed into *social and environmental impact documentation (SEID) costs*. This is because the participants often gave a single figure for both components instead of

separate ones. Second, the sub-cost component *other PDD costs* was not quantified as all participants regarded it to be negligible.

The **registration costs** were quantified by the author on the basis of the annual estimated amount of CERs generated by the project and the applicable registration fee.

The costs accruing from the **adaptation fee** were quantified by the author similar to the procedure applied in section 4.5. The anticipated amount of CERs generated over the crediting period was multiplied by the rate of the adaptation fee in order to calculate the total amount of CERs deducted. Subsequently, this amount was multiplied with the price likely to be agreed upon in the ERPA as announced by the respective buyer.

Cost figures given for the cost components in the cost groups **MATCs** and **PITCs** have not been discounted. As it can be guessed that they have accrued (or will accrue) at some point of time during the years 2002/3 discounting of such costs would be arbitrary and only have a minor impact on the magnitude of cost figures. However, **ITCs** should be discounted as these costs will arise periodically over the whole crediting period of ten years. Hence, it is crucial to know in which intervals the costs occur for each specific project. However, it is not clear when the projects will be registered. For reasons of illustration it is assumed that the projects will be registered as CDM projects until the end of 2003 and therefore will start operating in 2004. No cost figures for components in the implementation phase were given by the participants. Consequently, only the costs for the adaptation fee were discounted to their NPV in 2003. The discount rate chosen was 6%. It was known that for almost all projects the envisaged verification and certification period would be bi-annual. This means that the issuance and deduction of 2% of CERs takes place in the beginning of the years 2006, 2008, 2010, 2012 and 2014.

Specific transaction costs were calculated by dividing the absolute costs by the anticipated amount of CERs generated.

7.2 Results from the Quantification

Total transaction costs could not be quantified for any of the projects because approval costs, V+C costs as well as monitoring costs were not available. For each project at least 4 out of 9 components could not be quantified.

Table 13 provides an overview on the data availability⁸⁹ and the range of absolute and specific transaction costs for each cost component respectively cost group among all projects for which the respective cost component could be quantified⁹⁰.

⁸⁹ "Data availability" expresses for how many projects out of the 15 projects for which costs were obtained cost data was available.

Table 13: Data Availability and Range of Transaction Costs of Selected Potential CDM Projects in India

TACs (Data Availability)	Range	
	Absolute (\$US)	Specific (\$US/t CO ₂)
Search Costs (9) ¹⁾	19,000 – 29,000	0.005 – 0.091
Negotiation Costs (7)	10,500	0.002 – 0.044
PDD Costs (14)	6,500 – 120,000	0.004 – 0.125
Approval Costs (0)	---	---
Validation Costs (3)	6,000 – 80,000	0.003 – 0.080
Registration Costs (15)	5,000 – 30,000	0.006 – 0.042
Monitoring Costs (0)	---	---
V+C Costs (0)	---	---
Adaptation Fee (12)	10,193 – 212,349	0.042 – 0.088
Total TACs (0)	---	---
Min./Max. TACs Survey	57,193 – 481,849	0.062 – 0.470
1) Only those projects for which all sub cost components of search costs could be quantified are considered in this table.		

In order to give a first idea of the magnitude of transaction costs quantified table 12 also displays min. and max. absolute and specific total transaction costs. They have been calculated by adding up the lowest and highest figures respectively for each cost component quantified.

The costs quantified will be subject to a preliminary assessment in section 7.5.

A statement on the impact of the transaction costs quantified on the viability of the projects cannot be made at this stage. First, not all cost components have been quantified. Second, as shown in section 4.5 the impact of transaction costs on the viability of a CDM project will depend on the specific abatement costs of each single project and the price paid for the CERs.

However, it can be seen in table 13 that the min. specific transaction costs quantified are almost negligible and the maximum specific transaction costs quantified would theoretically allow projects with maximum abatement costs of 3.31 \$US/t CO₂ to be viable when assuming a CER price of 3.78 \$US/t CO₂.

⁹⁰ In case of the search costs all (sub-) cost components needed to be quantified.

In the following absolute costs quantified are presented (sub-)cost component by (sub-)cost component and it is stated for how much projects they have been available.

Search costs⁹¹ are available for 8 projects. Costs range from 19,000 - 29,000 \$US.

Data on *search activity costs* is available for 10 projects.

For some of the projects search activity costs have been negligible because either respective project developers directly targeted the buyers or because the involved intermediary already had pre-established links with a buyer (see IRC15, see IRC12, see IRC10).

For some projects it is not known how much costs have been spent on the search activities for the respective project as the CDM consultants that searched for a buyer did so for a number of projects at the same time. A straightforward allocation of these costs to a specific project is not possible. One participant stated that search activity costs usually accrue in the form of communication and information costs for an internet and e-mail based search. For a single project he quantified them to lie around 1,500 \$US (see IRC14). Another consultant assumed the costs to lie around 25,000 \$US for around 5 projects⁹² (see IRC05).

Project documentation costs are available for 9 projects.

Costs range from 15,500 \$US - 27,000 \$US. Project documentation costs for each project for which search costs could be quantified account for 90% or more in total search costs. The following cost ranges were quantified for the relevant sub-cost components:

- PIN costs: 2,000 – 4,000 \$US
- PCN costs: 2,000 – 7,000 \$US
- LoE costs: 1,000 – 10,000 \$US
- Additional documentation costs: 10,000 – 14,000 \$US

LoI costs are available for 9 projects. The costs accrued from negotiating and signing the LoI via e-mail. They range from 1,000 - 2,000 \$US.

Although ERPAs have not been signed so far a CDM consultant assumed **negotiation costs** to lie around 10,000 \$US for the projects he was involved in (see IRC12).

⁹¹ Please note that the search costs quantified do not include the costs for finding a seller of CERs that accrue to the buyer. Therefore, the search costs given in Appendix VI and VII only correspond to the costs for finding a buyer.

⁹² The exact number of projects was not given by the participant.

PDD costs have been quantified for 14 projects. For all projects eligible under the SSC rules the cost figures given refer to the simplified PDD. The PDD costs vary significantly from 6,500 - 120,000 \$US. For 8 projects cost figures for the PDD sub-cost components were available. The *baseline determination costs* range from 2,600 - 12,000 \$US. The *monitoring plan costs* vary between 1,600 - 6,000 \$US. The *social and environmental impact documentation costs* range from 2,000 - 7,200 \$US.

Approval costs were not quantified for any of the projects as none of the participants saw himself in the position to estimate the likely approval costs once the DNA will be set-up. All participants agreed that the LoE costs would be an unreliable reference for the approval costs as long as the rules and procedures of the to be established DNA are not publicly available. They also suspected that additional costs for approval would arise even for projects that have obtained a LoE already (see IRC14). This is especially due to the discussions among governmental officials about an approval fee (see IRC01; see IRC03; see IRC10).

Validation costs were quantified for 3 projects. They range from 6,000 - 80,000 \$US.

Registration costs were quantified for all projects and range from 5,000 - 30,000 \$US. None of the participants felt in the position to estimate the **monitoring costs** as well as the **V+C costs** as none of the projects is registered and implemented.

The costs accruing from the **adaptation fee** were quantified for 12 projects for which the potential buyer and the price he would pay for the CERs was known⁹³. The costs range from 10,193 \$US to 212,349 \$US.

7.3 Critical Appraisal of Results Quantified

The transaction costs quantified can be expected to be relatively uncertain due to various reasons. The reasons for uncertainty in absolute costs quantified are the following. First, during the interviews it was found that transaction costs in the least cases were accounted for in corporate accounting procedures which would have allowed a

⁹³ For the IDFC/PCF projects the average price of 3.15 \$US/t CO₂e averaged across the PCF portfolio has been used (see de Gouvello/Coto 2003, p. 9). In the case of the projects contracted under CERUPT the prices as stipulated in the ToR for the different project types has been used: 6.50 \$US/t CO₂e for renewable energy projects (excl. biomass), 5.20 \$US/t CO₂e for biomass and energy-efficiency projects and 3.90 \$US/t CO₂e for other project types (see Senter 2001, p. 5).

relatively straightforward and certain quantification by the participants. Such kind of cost data was usually only available once costs had accrued in form of consultancy fees or contractual payments. However, a significant part of the transaction costs consists of internal resources and time spent by the project developer and CDM consultants respectively. Therefore, a number of costs quantified come with considerable uncertainty.

Second, a considerable amount of costs need to be regarded as even more uncertain because they are estimates of future costs (e.g. negotiation costs for the IDFC/PCF projects, numerous PDD costs, costs accruing from the adaptation fee). Even the PDD costs for projects for which the PDD was completed need to be considered as relatively uncertain. The recent numerous methodology rejections by the EB might affect the selected projects as follows. If the Indian project developers consider their currently applied methodologies to be insufficient to be approved by the EB they might decide to up-date them. This in turn would lead to higher costs, which need to be added to the stated PDD costs.

Third, it was assumed that for all projects the first V+C takes place in 2006 because they are registered in 2003. However, due to the slow approval process at the EB this is not certain.

The specific transaction costs need to be considered as relatively uncertain because the amount of CERs that the projects will eventually generate is not certain.

First of all, the project developers might up-date their currently applied methodology. This will in turn change the amount of CERs eventually generated by the project. De Gouvello and Coto (2003) have shown that total emission reductions of their project varied as much as 26% from one baseline approach to another (see de Gouvello/Coto 2003, p. 7).

Moreover, the anticipated emission reductions might vary during project operation from the ex-ante expected value. A reason might be variations in project emissions due to uncertain product demand (e.g. heat, power, goods, etc), unexpected breakdown of machinery or uncertain fuel prices (see Janssen et al. 2001, p. 93).

Having said that, it should be noted that a more certain quantification of costs at this early stage of CDM project development in India is not possible. Costs quantified indicate the order of magnitude of transaction costs and provide a sufficient basis for further assessment.

7.4 Assessment of the Results

It is the objective of this section to conduct an assessment of the transaction costs quantified in the survey. First, the shares of the quantified transaction costs in the

project's total transaction costs are estimated (7.5.1). Subsequently, the impact of the project's total emission reductions on the specific transaction costs quantified is discussed (7.5.2). Subsequently, the major cost components among the costs quantified are identified and the factors they depend on are highlighted⁹⁴ (7.5.3). Finally, the total transaction costs are estimated for those projects for which the most cost components could be quantified and the impact of the total transaction costs on the viability of each project is discussed (7.5.4).

7.4.1 *Shares of Quantified Transaction Costs in Total Transaction Costs*

As described the three cost components **approval costs**, **monitoring costs** and **V+C costs** have not been quantified for any of the projects. It is the aim of this section to estimate the lowest and highest absolute values for these components. This procedure allows for a comparison with the magnitude of the lowest and highest cost figures for each component already quantified. Such a comparison will give a first impression of the shares of transaction costs quantified so far in the total transaction costs that accrue until the end of the crediting period. The following assumptions are made.

Concerning the **approval costs** it is estimated that the procedure for obtaining host country approval once the Indian DNA is in place will be similar to the existing procedure for obtaining the LoE. It is assumed that an approval fee will not need to be paid. In such a case the approval costs can be assumed to be in the same order of magnitude as the LoE costs quantified which means that they range from 1,000 - 10,000 \$US.

In table 6 **monitoring costs** have been estimated to be 10,000 \$US for a crediting period of ten years. It is assumed that the same costs accrue to potential CDM projects in India (i. e. 1,000 \$US per year). Each annual payment was discounted to its' NPV with a discount rate of 6%, leading to total monitoring costs of 6,550 \$US for each project.

Estimates on the **V+C costs** per turn were presented in table 6. They range from 3,000 to 15,000 \$US. As described in section 7.2 it is anticipated that V+C for each project will take place bi-annually in the years 2006, 2008, 2010, 2012 and 2014. Discounting of payments leads to total V+C costs in the range of 10,112 - 50,559 \$US.

Table 14 presents the costs already quantified in the survey and the costs estimated by the author via above described procedure. The costs are given in absolute terms and in % of the total TACs for the lowest and the highest value found.

⁹⁴ As stated in section 4.5 an identification of their dependence on certain factors might help proposing measures for reducing the transaction costs for CDM projects. However, it is not within the scope of this study to identify such measures.

Table 14: Shares of Transaction Costs Quantified in Total Transaction Costs of Selected CDM Projects in India

TACs (Data Availability)	Lowest Cost Figures		Highest Cost Figures	
	\$US	Share in Total TACs (%)	\$US	Share in Total TACs (%)
Search Costs (9)	19,000	25.4	29,000	5.3
Negotiation Costs (7)	10,500	14.0	10,500	1.9
PDD Costs (14)	6,500	8.7	120,000	21.9
Validation Costs (3)	6,000	8.0	80,000	14.6
Registration Costs (15)	5,000	6.7	30,000	5.5
Adaptation Fee (12)	10,193	13.6	212,349	38.7
TACs Survey	57,193	76.4	481,849	87.8
Approval Costs	1,000	1.3	10,000	1.8
Monitoring Costs	6,550	8.8	6,550	1.2
V+C Costs	10,112	13.5	50,559	9.2
TACs Estimates	17,662	23.6	67,110	12.3
Total TACs	74,885	100.0	548,959	100.0

Table 14 shows that with the assumptions made the lowest absolute costs quantified in the survey account for around 76% of the lowest total transaction costs. The highest costs quantified account for around 88%. Therefore, it can be concluded that the major share of the total transaction costs that accrue to the selected projects was quantified in the survey.

It can also be seen in table 14 that the share of each cost component in total transaction costs varies from lowest to highest value. This is especially evident in case of the following components.

The shares of **search costs** and **negotiation costs** with 25.4% and 14.0% respectively in lowest transaction costs is much higher than in case of the highest transaction costs with 5.3% and 1.9% respectively.

In contrast to that **PDD costs** and costs arising from the **adaptation fee** with 21.9% and 38.7% respectively in highest transaction costs are significantly higher than in the case of lowest transaction costs with 8.0% and 13.6% respectively.

An explanation for the dominating status of costs that accrue from the **adaptation fee** in highest transaction costs is that this is the only cost component which is majorly influenced by the project's total emission reduction. It could be observed that the project

with the highest emission reduction faces highest costs accruing from the **adaptation fee** and the project with the lowest emission reduction facing lowest costs⁹⁵.

The significantly lower shares of **search costs** and **negotiation costs** in highest transaction costs might indicate that there is a “ceiling” for these costs as they accrued to a number of projects around the same order of magnitude. In contrast to that discrepancy in **PDD costs** is much more significant and consequently the share of PDD costs rises from lowest to highest transaction costs.

7.4.2 *Impact of the Total Emission Reduction on Specific Transaction Costs*

In section 4.6 it was shown that specific transaction costs seem to be mainly determined by a project’s total emission reduction due to economics of scale. However, the calculations in section 4.6 were based on manufactured generic project types and general estimates on the absolute transaction costs. In this section the project-specific costs quantified for each cost component are used to assess the impact of the project’s emission reduction on the project’s specific transaction costs.

Appendix V puts the specific transaction costs for each cost component quantified in the survey for each project in relation to the project’s emission reduction.

Appendix V clearly demonstrates a degression in specific costs due to economics of scale as the majority of costs has a tendency to be lower with higher emission reductions.

Search costs, **PDD costs** and **registration costs** show a strong cost degression with rising emission reductions as illustrated by the respective trend lines. When following the trend lines it can be observed that the cost degression is only marginal with emission reductions higher than 2 Mt CO₂e but much more significant the lower the emission reduction is below 2 Mt CO₂e.

Such a degression cannot be observed for the validation costs and the costs accruing from the adaptation fee.

For the former this might be due to low data availability as validation costs have only been available for three projects.

In case of the latter it can be observed that 8 out of 11 projects have similar specific costs. The reason is that absolute costs for the adaptation fee rise proportional to the emission reduction and therefore the specific costs differ from project to project by the price that will be paid for the CERs.

⁹⁵ Please note that the costs arising from the adaptation fee also depend on the CER price.

However, it cannot be concluded that the project with the highest emission reduction necessarily has lowest specific transaction costs.

Table 15 contains the lowest and the highest specific transaction cost value for each cost component quantified. It also displays the total emission reduction of the corresponding project for which the lowest and the highest specific costs respectively could be quantified for the component in question. The last column displays the total emission reduction of the project with the lowest emission reduction among all projects for which the cost components could be quantified.

It can be observed that the lowest specific cost values for each cost component belong to the projects which either generate the highest or second highest total amount of CERs (5.0 Mt CO₂e and 4.5 Mt CO₂e respectively). The highest specific costs belong to the projects which generate CERs in the amount of 1.0 Mt CO₂e or lower. However, table 15 also shows that the project with the lowest (highest) emission reduction among the projects for which data was available has not necessarily the highest (lowest) specific transaction costs. Consequently, it needs to be concluded that projects exist for which the absolute transaction costs accrued to such an extent that the high emission reduction could not compensate them. This results in higher specific transaction costs for these projects compared to projects with lower emission reductions.

Table 15: Dependence of Specific Transaction Costs of Selected CDM Projects in India on the Total Emission Reduction of the Project

TACs (Data Availability)	Lowest Specific TACs (\$US/t CO₂)	Total ER of Project with Lowest Specific TACs in Cost Component (Mt CO₂e)	Highest Specific TACs (\$US/t CO₂)	Total ER of Project with Highest Specific TACs in Cost Component (Mt CO₂e)	Lowest Total ER among Projects for which Data is available for Cost Component (Mt CO₂e)
Search Costs (9)	0.005	5.00	0.091	0.31	0.24
Negotiation Costs (7)	0.002	5.00	0.044	0.24	0.24
PDD Costs (14)	0.004	4.53	0.125	0.36	0.15
Validation Costs (3)	0.003	4.53	0.080	1.00	0.38
Registration Costs (15)	0.006	5.00	0.042	0.24	0.15

7.4.3 Identification of Major Transaction Cost Components and an Assessment of Factors They Depend on

Table 16 displays the lowest and highest specific cost values for each cost component for which data was obtained as well as the sum of each.

Table 16: Shares of Cost Components in Specific Transaction Costs Quantified for CDM Projects in India

TACs (Data Availability)	Lowest Cost Figure		Highest Cost Figure	
	\$US/t CO ₂	Share in SUM (%)	\$US/t CO ₂	Share in SUM (%)
Search Costs (9)	0.005	8.1	0.091	19.4
Negotiation Costs (7)	0.002	3.2	0.044	9.4
PDD Costs (14)	0.004	6.5	0.125	26.6
Validation Costs (3)	0.003	4.8	0.080	17.0
Registration Costs (15)	0.006	9.7	0.042	8.9
Adaptation Fee (12)	0.042	67.7	0.088	18.7
SUM TACs Survey	0.062	100	0.470	100

It can be seen that costs from the **adaptation fee** with almost 68% have by far the highest share in the lowest specific transaction costs quantified. It can be assumed that this is due to the fact that this is the only cost component where economies of scale do not occur. In comparison with the costs accruing from the adaptation fee the share of the other cost components which each lie in the range of 3.2% to 9.7% can be considered to be minor.

Costs for the **adaptation fee** with a share of 18.7% are considerably less dominating in the highest specific transaction costs. As stated in section 7.5.2 the difference from lowest to highest specific costs for the adaptation fee equals the difference in CER prices to be paid. When considering the other cost components it can be seen that **PDD costs** (26.6%), **search costs** (19.4%) and **validation costs** (17.0%) have a much higher share than **negotiation costs** and **registration costs** with 9.4% and 8.9% respectively. It can be concluded that PDD costs, search costs, validation costs and the adaptation fee contribute the main share in the sum of specific transaction costs quantified for projects

with relatively low emission reductions⁹⁶. Hence, those cost components can be assumed to affect the viability of CDM projects to a large extent.

On the basis of the quantified results as well as on general remarks from the participants in the survey it is assessed on which factors the PDD costs, search costs and validation costs depend on⁹⁷. Please note that in the following it is not explicitly stated that the specific cost values for each component mainly depends on the total emission reduction of the project. The main purpose of the last part of this section is to highlight factors the absolute costs depend on.

The aggregated share of *baseline costs* and *monitoring plan costs* in overall **PDD costs** for 8 projects for which they are available ranges from 65% to 67%. Consequently, the *SEID costs* range from 32% to 35%. When comparing the average absolute SEID costs for SSC (3,050 \$US) with non-SSC projects (6,300 \$US) one observes that the SSC projects on average have more than 50% lower SEID costs. Therefore, it can be concluded that the SEID costs are lower for SSC projects than for non-SSC projects.

Appendix VI displays the aggregated *baseline costs* and *monitoring plan costs* in absolute and specific terms. In order to allow for a comparison of the costs according to the complexity of the underlying project, the costs have been distributed among five groups which represent different degrees of project complexity.

In section 4.4.2.1.1. it has been assumed that project complexity rises the more components a project consists of. Here, complexity is also assumed to increase the higher the number of sources that give rise to GHG emission in the project is⁹⁸.

In appendix VI the number in brackets behind the group illustrates for how many projects cost figures were available in the respective group. The numbers at the top of the columns show the average total emission reduction among the projects of the respective group. Table 17 explains the groups.

⁹⁶ As shown in table 15 these are the projects with emission reductions from 0.24 - 1.00 Mt CO₂e.

⁹⁷ The dependence of the costs for the adaptation fee on the total emission reduction and the CER price has already been comprehensively highlighted.

⁹⁸ An example for a project with a high number of GHG emission sources would be a project in the traffic sector with a high number of vehicles involved. It can be assumed that for such a project the baseline and monitoring plan is very complex.

Table 17: Selected CDM Projects in India and Their Belonging to Project Groups with Different Degree of Project Complexity

Group	Explanation
BL 1 Comp.	The project consists of one component (e.g. supply of electricity to the grid)
BL 1 Comp., SSC	The project consists of one component and is eligible to use the simplified PDD
BL 2 Comp.	The project consists of two components (e.g. a co-generation project which supplies electricity to the grid and uses the heat on-site)
Emission Sources Clustered	The project proposes to reduce GHG emissions at more than one “source” (e.g. fuel switch in a vehicle fleet)
Emission Sources Clustered, SSC	The project proposes to reduce GHG emissions at more than one “source” and is eligible to use the simplified PDD

It is assumed here that generally “BL 2 Comp.” and “Emission Sources Clustered” projects are more complex than a “BL 1 Comp.” project. It is also assumed that generally a SSC project will be less complex than a non-SSC project of the same group due to the simplified methodologies. A general judgement on if a “BL 2 Comp.” is more complex than a “Emission Sources Clustered” project or *vice versa* is not made as this can be assumed to be very case-dependent.

In appendix VI it can be observed that for non-SSC projects the absolute baseline and monitoring plan costs rise on average from 12,000 \$US for “BL 1 Comp.” projects to 16,400 \$US for “BL 2 Comp.” projects. They are equal for “BL 1 Comp.” projects and the project where numerous emission sources are clustered. It can also be seen that absolute costs for the “BL 1 Comp., SSC” projects are almost 50% lower than for the “BL 1 Comp.” projects. In the case of the “Emission Sources Clustered” projects the costs for the SSC project are even almost two third lower than for the non-SSC project. Bearing in mind that the data availability is very low appendix VI gives rise to the following conclusions.

For SSC projects absolute baseline and monitoring costs are considerably lower than for non-SSC projects. For non-SSC projects they rise from “BL 1 Comp.” projects to “BL 2 Comp.” projects. An increase in costs from “BL 1 Comp.” projects to “Emission Sources Clustered” projects cannot be observed.

However, appendix VI also shows that it is more beneficial to develop complex projects if they guarantee a much higher emission reduction than less complex projects in order to achieve economics of scale.

It is clearly observable that the group with the highest average absolute costs has with 0.003 \$US/t CO₂ the lowest specific costs. For example the complex “BL 2 comp.” projects on average reduce 6 times more GHG emissions than the “BL 1 Comp.” projects but on average have only 1.4 times higher absolute costs. Compared to the “BL 1 Comp., SSC” projects the “BL 2 comp.” projects reduce 19 times more GHG emissions but on average have only 3.9 times higher absolute costs.

As described, *project documentation costs* account for around 90% of **search costs** for each project⁹⁹.

It was found that *PIN, PCN and additional documentation costs* depend on the requirements of the buyer. First, Senter has not required a PCN whereas the PCF has. Second, some buyers required different types of documentation additional to the PIN (and PCN).

Participants in the survey said that PIN, PCN and additional documentation will be usually prepared by the project developer with strong assistance from a CDM consultant (see IRC05; see IRC06; see IRC09; see IRC10; see IRC14; see IRC15). They stated that the costs for preparation of the documents to a considerable degree depend on the consultants’ level of information on the project as well as the distance of the project developers’ company and the project from the consultants’ company (see *ibid*). They also stated that the project type has a minor influence (see *ibid*). Some participants said that *LoE costs* strongly depend on the distance of the party that attends the meeting at MoEF in New Delhi (see IRC05; see IRC10; see IRC14; see IRC15). For example it was found that *LoE costs* for projects where staff from the consultancy based in New Delhi attended the meeting were 1,000 – 2,000 \$US. Once staff from outside New Delhi or India was present at MoEF the costs were 10,000 \$US. This cost difference is due to higher travel costs in the latter case.

Data availability for **validation costs** is with three cost figures very low. The project’s validation costs are also distributed according to their complexity among the groups introduced above as shown in table 18.

⁹⁹ Please note that the search costs quantified do not include the costs for finding a seller of CERs that accrue to the buyer.

Table 18: Validation Costs and Project Complexity of Selected Potential CDM Projects in India

Project	Group	Validation Costs (\$US)
Wind	BL 1 Comp.	6,000
Biomass Co-generation	BL 2 Comp.	15,000
Energy Efficiency	"Emission Sources Clustered" + BL 2 Comp.	80,000

The energy efficiency project with 80,000 \$US has significantly higher absolute validation costs than the other two projects with 15,000 \$US and 6,000 \$US. The project can be assumed to be the most complex project among all 15 projects because besides the two project components it also involves clustered emission "sources" (see IRC11). The biomass project is more complex than the Wind project and has higher validation costs. Hence, it can be concluded that the absolute validation costs depend on the project complexity and rise with it. Concerning the validation costs for the wind project it is known that the validator was the same OE that already validated the baseline of the project for the CERUPT tender. The project developer stated that the validator charged less for validation than he would have done if he would not have been familiar with the project (see IRC14).

7.4.4 Total Transaction Costs of Selected Projects and Discussion of Their Impact on the Project's Viability

It is the purpose of this section to carry out an estimation of the total transaction costs for projects for which the most cost components were quantified in order to provide for the calculation of the project's total specific transaction costs.

7 projects for which only four cost components could not be quantified are displayed in table 18. The costs not quantified have been estimated in order to calculate total transaction costs for each project. For this calculation the following assumptions were made.

It was assumed that *negotiation costs* for the projects for which the negotiation costs could not be obtained would also be 10,000 \$US as estimated for some of the projects in section 7.2.

It was assumed that the project developers receive host country approval on the basis of the already granted LoE once the DNA is set-up for those projects that already obtained

a LoE. However, some costs were expected to accrue for communication between the DNA and the project developers which might include a meeting at the DNA. It was assumed that the DNA will not charge an approval fee and therefore the ***approval costs*** would be in the magnitude of 2,000 \$US for communication and time spent.

For the projects that have not obtained a LoE it is assumed that the approval costs as for obtaining LoE costs for the other projects will accrue. Consequently, the approval costs will also be 2,000 \$US.

Table 19: Absolute Total Transaction Costs of Selected CDM Projects in India

TACs	MSW Treatment	Biomass	Hydro	Wind	Wind	Fuel Switch	Wind
	\$US	\$US	\$US	\$US	\$US	\$US	\$US
Negotiation Costs	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Approval Costs	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Validation Costs	25,000	15,000	10,000	12,000	12,000	25,000	---
Monitoring Costs	6,550	6,550	6,550	6,550	6,550	6,550	6,550
V+C Costs	50,559 (15,000)	40,447 (12,000)	16,853 (5,000)	33,706 (10,000)	33,706 (10,000)	50,559 (15,000)	33,706 (10,000)

For the **validation costs** the following estimates were made. A OE charged 15,000 \$US for the validation of a biomass co-generation project which according to above project groups would be a “BL 2 comp.” project (see IRC14). As the biomass project included in table 20 is also a co-generation project it was anticipated to have the same validation costs.

As shown it can be assumed that validation costs depend on the project complexity. It was guessed that validation costs for the MSW treatment and the fuel switch project to be considerably higher than for the biomass co-generation as they are known to be more complex. For both projects validation was guessed to cost 25,000 \$US.

As the wind projects are “BL 1 comp.” projects they are assumed to involve lower costs than the biomass project. For these projects validation was assumed to cost 12,000 \$US. Costs for the hydro project with 10,000 \$US were expected to be lower as the project is a “BL 1 comp., SSC” project.

For the estimation of the **monitoring costs** the same procedure as outlined in section 7.4.1 was applied. It was anticipated that all projects bear the same monitoring costs. This resulted in 6,550 \$US for each project.

Concerning the **V+C costs** the same rationale as in the case of the validation costs was applied. The more complex a project the higher the V+C costs were assumed to be. The assumptions on the magnitude of the V+C costs for each bi-annual V+C are given in brackets in table 18. The same approach as outlined in section 7.5.1 was used to calculate the NPV of the V+C costs over the crediting period.

The total estimated absolute transaction costs for the selected projects range from 97,696 - 364,847 \$US. They cannot be displayed for every single project as this would be violate the confidentiality agreement with the participants¹⁰⁰.

The assumptions made above result in total specific transaction costs of each project as displayed in table 20¹⁰¹. The costs range from 0.07 - 0.47 \$US/t CO₂.

Table 20 also displays the range of CER prices the project developers receive from potential buyers. The project developers will either sell to CERUPT or the PCF.

As the author has obtained information for which prices CERs will be sold from each project the share of total transaction costs in the CER price could be calculated.

It ranges from 2.2% to 13.0%.

¹⁰⁰ If the total absolute costs for each project would be given this would allow for the calculation of each project’s emission reduction with the help of the specific transaction costs given in table 20 below.

¹⁰¹ Please note that the search costs quantified do not include the costs for finding a seller of CERs that accrue to the buyer.

Following the argumentation that a project's sum of specific abatement costs and specific total transaction costs needs to be lower than the CER price in order to be viable, the projects could bare maximum abatement costs as displayed in table 19. They range from 2.74 – 6.34 \$US/t CO₂.

Unfortunately, abatement costs could not be quantified for any of the projects.

Shukla (2002) has estimated long-term marginal abatement cost ranges for various CO₂ mitigation options in India. He estimated that there is mitigation potential in the amount of 84 Mt CO₂ for renewable energy technologies with abatement costs from 1 – 4 \$US/t CO₂ (see Shukla 2002).

When assuming that this abatement cost range applies to the 5 renewable energy projects in table 20 it can be concluded that if they would all have received a LoI from Senter that they would be viable. As not all of them have done so the viability of some projects will depend on the specific abatement costs.

However, it can be observed that even when assuming that all renewable energy projects would receive 3.15 \$US/CER their max. abatement costs with 2.68 – 3.08 \$US/t CO₂ would still lie at the higher end of Shuklas' (2002) abatement cost range.

For the MSW Treatment and the fuel switch project no abatement cost estimates were available.

The findings of this section can be summarised as follows.

A definite statement on the impact of transaction costs on the viability of each project could not be made as the abatement costs of the projects are not known. However, it can be seen that for some of the projects the transaction costs are almost negligible when compared to the CER price paid.

It can be concluded that the transaction costs do not impact the viability of at least some of the projects when assuming typical abatement costs.

Finally, it has to be mentioned that the transaction costs quantified are not prohibitive and that their impact will be marginal if CER prices exceed the currently observed price range of 3.15 - 6.50 \$US/t CO₂. For example EcoSecurities (2001) has shown that permit prices in the international GHG market under various international trading scenarios might go as high as 136 \$US/t CO₂ for the year 2010 (see EcoSecurities 2001, p. 21).

Table 20: Total Specific Transaction Costs of Selected CDM Projects in India and Their Impact on the Project's Viability

TACs	MSW Treatment	Biomass	Hydro	Wind	Wind	Fuel Switch	Wind
Total Specific TACs (\$US/t CO₂)	0.13	0.07	0.41	0.16	0.24	0.12	0.47
CER Price (\$US/t CO ₂)	3.15 – 3.90	3.15 – 5.20	3.15 – 6.50	3.15 – 6.50	3.15 – 6.50	3.15 – 3.90	3.15 - 6.50
Max. ACs (\$US/t CO ₂)	3.02 – 3.77	3.08 – 5.13	2.74 – 6.09	2.99 – 6.34	2.91 – 6.26	3.03 – 3.78	2.68 - 6.03
AC Estimate (\$US/t CO ₂) (see Shukla 2002)	---	1 - 4	1 – 4	1 – 4	1 – 4	---	1 – 4

7.5 First Discussion of Future Development of Transaction Costs of CDM Projects in India

Almost all participants in the survey stated that they expect transaction costs to decrease once more experience is gained with CDM (see IRC01; see IRC02; see IRC06; see IRC07; see IRC10; see IRC12; see IRC14; see IRC15).

Judging from the vast GHG mitigation potential and the considerable capacity of the Indian private sector to develop potential CDM projects a large number of potential CDM projects can be expected to be developed in India in the future.

It is the objective of this section to carry out a first qualitative discussion of the possible future development of transaction costs of potential Indian CDM projects to come. To this end selected cost components will be discussed with regard to their potential future development. The discussion is only concerned with absolute costs and builds on findings presented in this study as well as on information obtained during the survey that has not been presented so far.

In section 7.3 it was found that *project documentation costs* account for around 90% of *search costs*. Table 21 displays the potential buyers Indian project developers are known to negotiate ERPAs with as well as the documentation the buyers require(d) before the LoI is (was) signed.

The table also distinguishes between the search strategy of the buyers. They have either chosen to purchase CERs through tenders with a limited time frame (e.g. CERUPT and GoF) or through long-term acquisition¹⁰² (e.g. PCF).

Table 21: Search Strategy of Buyers and Required Documentation

Search Strategy of Buyer	Limited Time Frame Tenders		Long-term Acquisition	
			Without Intermediary	With Intermediary
	CERUPT	GoF	PCF	IDFC/PCF
Required Documentation	PIN, LoE, Validated Baseline	PIN or PDD, LoE	PIN, PCN, LoE	PIN, PCN, LoE, Due Dilligence Test

Source: see Senter (2001), p. 16f.; see PCF (2003b); see MoFA (2003b), p. 2; see IRC14

¹⁰² „Limited time frame tender“ in this context means that the tender has a deadline until which project developers needed to submit their offer. In contrast to that the PCF strategy is here referred to as a “long-term acquisition” as no such deadline do exist and project developers can submit offers continously until the funds resources come to an end.

A number of participants stated that they expect the project documentation costs to decrease in the future due to the following reasons. First of all, once the DNA is in place the project developers can directly obtain host country approval and do not have to seek host country endorsement first¹⁰³ (see IRC01; see IRC05; see IRC10; see IRC14; see IRC15). Second, potential buyers already provide for project developers to directly submit a PDD for consideration by the buyer (e.g. GoF). In such a case PIN and PCN costs do not arise. A CDM consultant that was involved in a CDM project that tendered under CERUPT as well as a project that tendered under the Finnish JI/CDM Pilot Programme clearly stated that project documentation costs under the latter were much lower as the project developer directly submitted a PDD to the GoF (see IRC15). No PIN and validation of the baseline was required. He also stated that under CERUPT the validation of the baseline was required to give the buyer an indication of the quality of the baseline as in 2001 the experience with baseline development was very low (see *ibid*). It is expected that no potential future buyer will make this a requirement again (see IRC12; see IRC15).

If the PCF purchases CERs from projects that directly submit a PDD as project documentation is not known. However, when considering that due diligence testing is a strict requirement in the IDFC/PCF route it can be assumed that project documentation costs for projects that follow this route in the future will be higher than in the case of future tenders designed like the Finnish JI/CDM Pilot Programme.

Finally, it should be noted that even though potential buyers might except PDDs as project documentation, the potential seller has to decide which documentation he wants to submit. This will very likely depend on the risk aversion of the seller as the review of the PIN by the buyer might give the seller an early indication if a buyer is prepared to buy CERs from his potential project.

One could expect the future development of project documentation costs to depend both on the future documentation requirements of buyers as well as the decision of the seller which documentation to submit to the buyer. A general statement cannot be made.

An estimation on the future development of **negotiation costs** is not made as the costs quantified are estimates and only come from one source.

The assessment of the **PDD costs** in section 7.5.3 has shown that baseline and monitoring plan costs seem to depend on project complexity. All participants in the survey said that in the future PDD costs will be determined by learning-effects gained from past PDD development. They assumed the complexity of the project to be less influential once an experienced CDM consultant/project developer does the PDD (see

¹⁰³ The participants expected additional costs to accrue during obtaining host country approval for projects which have already received a LoE (see section 7.2).

IRC01; see IRC06; IRC09; see IRC10; see IRC14; see IRC15). However, it can be assumed that this statement is only valid for project types with which the respective project CDM consultant/project developer has already gained experience (see IRC14; see IRC15).

One can expect PDD costs for Indian CDM projects in the short-term to decrease due to learning-effects for project types for which several PDDs have already been finalised. When considering table 10 this will very likely be the case for biomass and wind projects as they account for the majority of Indian projects. In how far learning-effects influence PDD costs of other project types in the mid- and long term can be anticipated to depend on how many projects will be developed in the respective project category.

It can also be assumed that learning-effects will arise on the part of the validators (see IRC01; see IRC13). To which extent they will be passed through to the project developers in terms of lower **validation costs** can be assumed to depend on the degree of competition among validators. A number of participants stated that an Indian OE performing validation and V+C very likely charges lower rates because of lower labour costs in India (see IRC01; see IRC10; see IRC14; see IRC15). However, so far only DOEs from developing countries have applied for accreditation. Hence, it can be assumed that in the mid-term a validation cost reduction is not likely.

Once the COP has decided on a percentage to be retained by the EB for its administrative expenses an administration fee will supersede the currently existing registration fee. As the magnitude of the future fee is uncertain as well as the time when it will come into force no estimates on the future development of the **registration costs** can be made. However, it is clear that the proposed administration fee due to its proportional design will mean equal specific transaction costs for all projects irrespective of how many CERs they generate.

The **monitoring costs**, **V+C costs** as well as the costs accruing from the **adaptation fee** will not be further considered due to the following reasons. For the first two cost components a quantification was not possible. However, for the V+C costs it can be assumed that their future development will be influenced by the same factors as outlined for the validation costs. The adaptation fee is not very likely to change in the near future.

8 Summary and Scope for Further Research

It was the objective of this study to empirically quantify transaction costs of potential CDM projects in India and to conduct a preliminary assessment of the results found. Sink CDM projects were not within the scope of this study. Methodologically this study was split into two parts.

The first part was concerned with the definition of transaction costs of CDM projects and their cost components that could be used in an empirical survey to quantify transaction costs of CDM projects. The methodological approach to define transaction costs and their components built on the following. First, the review of relevant literature on transaction costs of CDM projects. Second, on information of institutional design options for CDM projects as well as of developments in the current CER market. For the purpose of this study transaction costs of CDM projects were defined as the sum of costs from the tasks to be performed in the CDM project cycle that accrue until the end of the (last) crediting period as well as costs that accrue from search and negotiation activities involved in uni-, bi- and multilateral projects.

Transaction costs of CDM projects consist of the cost components search costs, negotiation costs, PDD costs, approval costs, validation costs, registration costs, monitoring costs, verification and certification costs and costs accruing from the adaptation fee.

A discussion on which factors the magnitude of transaction cost components depends on showed that they depend on a variety of factors and that absolute transaction costs are very project-specific.

Estimates on the magnitude of transaction costs and a discussion of their potential impact on the viability of CDM projects found the following. First, in order for projects to be viable the sum of specific abatement costs and the specific transaction costs needs to be lower than the CER price. Second, the major determinant of the specific transaction costs is the total emission reduction of the project. Therefore, the higher the emission reduction of a project, the higher the probability that the transaction costs do not impact the project's viability.

The second part was concerned with the methodology used for the quantification of transaction costs of CDM projects in India. A survey among the players involved in CDM projects in India was identified to be an appropriate means for quantification. The survey consisted of a round of personell interviews with players involved in CDM in India and the exchange of electronic questionnaires. The quantification was carried out

on a project-specific basis. The participants in the survey were asked to directly quantify parts of the transaction cost components defined in this study for projects they were involved in. Some transaction cost components were quantified by the author with other information than direct costs given by the participants.

Around 65 potential CDM projects were found to be currently developed in India. At the time of writing not a single project was registered by the EB. For 15 unilateral projects parts of transaction costs could be quantified. For each project at least 4 out of 9 cost components could not be quantified. The lowest (highest) specific transaction costs aggregated over all projects for which data was available resulted in 0.06 \$US/t CO₂ (0.47 \$US/t CO₂).

An assessment of the results found the following.

The findings suggest that around 76% to 88% of the total transaction costs were quantified.

The specific abatement costs are mainly determined by a project's total emission reduction. For all cost components apart from the costs accruing from the adaptation fee a significant cost degression with rising emission reductions due to economics of scale was observed.

The dominant share in total specific transaction costs for projects with high emission reductions have the costs accruing from the adaptation fee (68%) which depend on the project's emission reduction and the CER price.

The major shares in the highest specific costs quantified are the PDD costs (27%), followed by the search costs (19%), the costs accruing from the adaptation fee (19%) and the validation costs (17%). PDD costs seem to increase with project complexity. Project documentation costs contribute around 90% to the search costs and mainly depend on the requirements of the buyer. Costs accruing from the adaptation fee are directly proportional to a project's emission reduction and the CER price. Validation costs also seem to rise with project complexity.

Estimation of total transaction costs for 7 projects for which the CER prices were available (3.15 - 6.50 \$US/t CO₂) resulted in specific total transaction costs of 0.07 - 0.47 \$US/t CO₂.

A final statement in how far transaction costs impact the viability of the projects cannot be made as the project's abatement costs were not given by the participants in the survey. However, when considering typical abatement costs for renewable energy projects in India (1 - 4 \$US/t CO₂) it can be assumed that a number of these projects are viable.

Finally, a first qualitative discussion on the potential future development of transaction costs in India showed that in the short-term no considerable decreases in transaction costs can be expected.

Considering the rather broad definition of transaction costs it was not within the scope of this study to cover all relevant aspects of transaction costs of CDM projects comprehensively. This was also due to the early stage of the CDM and of empirical research on transaction costs of CDM projects.

On the basis of this study it can be concluded that it appears to be promising to direct the focus for further research on the following areas.

First, in this study data availability for costs quantified was very low and the assessment of the results have a very preliminary character. One can expect much more data to be available as the CDM market evolves and more projects are being developed and registered. Hence, further empirical quantification will increase the understanding of the magnitude of transaction costs of CDM projects as well as the factors they depend on.

Second, transaction costs that accrue to the buyer of the CERs were not quantified in this study. As briefly shown different buyers have chosen different strategies for purchasing CERs. Hence it would be interesting to quantify buyers transaction costs and identify the factors they depend upon.

Third, the present study was limited to non-sink CDM projects. The international rules for sink projects are expected to be finalised at COP9 in December 2003 (see Jung 2003, p. 2). Thus it would be interesting to explore if transaction costs of sink projects will significantly differ from those of non-sink projects.

Fourth, this study showed that one needs to distinguish between unilateral, bilateral and multilateral CDM projects. None of the projects the author obtained information for was bi- or multilateral. It is argued that bi- and multilateral CDM projects bring significantly more benefits to the host country than unilateral projects (see Baumert/Kete/Figueroes 2000, p. 6ff.). Hence it would be interesting to explore if and in how far transaction costs hamper the development of bi- and multilateral projects.

Appendix I

Overview on 28 Potential CDM Projects

Country	Buyer	Project Type	CERs (t CO ₂ e)
Bolivia	CERUPT	Energy Efficiency	327,083
Brazil	PCF	Fuel Switch	12,041,356
Brazil	CERUPT	Biomass	195,984
Brazil	CERUPT	Landfill Methane	695,880
Brazil	NCDF	Fuel Switch	21,000,000
Brazil	NCDF	Landfill Methane	11,800,000
Chile	PCF	Hydro	2,812,000
China	CERUPT	Wind	606,476
Colombia	PCF	Wind	1,168,000
Costa Rica	PCF	Wind	500,000
Costa Rica	PCF	Hydro	100,000
Costa Rica	CERUPT	Energy Efficiency	491,000
Costa Rica	CERUPT	Hydro	806,800
Costa Rica	CERUPT	Landfill Methane	974,971
El Salvador	CERUPT	Geothermal	100,000
India	CERUPT	Wind	340,000
India	CERUPT	Biomass	300,000
India	CERUPT	Biomass	1,150,000
India	CERUPT	Wind	272,000
India	CERUPT	Wind	475,607
Indonesia	CERUPT	Geothermal	5,432,000
Jamaica	CERUPT	Wind	4,572,00
Mauritius	PCF	Waste Incineration	2,800,000
Panama	CERUPT	Hydro	3,397,129
Panama	CERUPT	Hydro	330,806
Panama	CERUPT	Hydro	224,800
South Africa	PCF	Landfill Methane	4,720,000
Uganda	PCF	Hydro	1,884,000
Total			74,945,892

Source: see de Coninck/van der Linden (2003), p. 11 ; see PCF (2003d); see Senter (2003).

Appendix II

Major Questions Raised During the Interviews

Group	Q1: In which (potential) CDM projects is your company currently engaged in (e.g. technical description, abatement costs, etc) ?	Q2: What are the transaction costs that accrued so far for each project?	Q3: What do you assume to be the factors that the transaction costs depend upon?	Q4: For which transaction cost components do you see a scope for reduction? Why?	Q5: What is the progress in the operationalisation of the CDM in India?	Q6: What is your perception of the current situation of the CDM in India? What do you regard as important issues that need to be addressed?
Project Developers	X	X	X	X		X
CDM Consultants	X	X	X	X		X
Financial Institutions	X	X	X	X		X
Governmental Representatives					X	X

Appendix III

List of Participants in the Survey Quoted in This Study

Expert Group ¹	Date of Interview	Participation in Electronic Questionnaire	Interview Reference Code
C	11.03.03		IRC01
C	11.03.03		IRC02
GR	11.03.03		IRC03
GR	12.03.03		IRC04
C	26.03.03	X	IRC05
C	01.04.03		IRC06
FI	01.04.03		IRC07
GR	01.04.03		IRC08
PD	03.04.03		IRC09
FI	07.04.03	X	IRC10
PD	08.04.03	X	IRC11
PD	09.04.03		IRC12
C	09.04.03		IRC13
C	14.04.03	X	IRC14
C	09.06.03	X	IRC15
1) PD=Project Developers; C=Consultants; FI=Financial Institutions; GR=Governmental Representatives			

Appendix IV

Sample Questionnaire

Transaction Costs of CDM Projects in India

An Electronic HWWA Questionnaire

Recipient:

XXX

July 2003

Matthias Krey, Programme “International Climate Policy”, Hamburg Institute of International Economics (HWWA), Neuer Jungfernstieg 21, 20347 Hamburg, Germany, Tel.: +49(0)4042834-349, Fax: -451, matthias.krey@hwwa.de

An Introduction to the Research Project: Transaction Costs of CDM Projects in India – A Preliminary Empirical Survey

It is the aim of the research activity to quantify transaction costs of CDM projects in India by gathering empirical data from among the CDM project developers, consultants and facilitators.

To that end transaction costs of CDM projects and their cost components have been defined and compiled by the HWWA. In March and April 2003, during a one month visit to India approximately 30 interviews have been carried out among CDM experts from the Indian private sector and governmental representatives involved in the operationalisation of CDM.

The information collected during that time has been used to design questionnaires that are specifically tailored to every experts' activities in CDM projects. Such questionnaires are currently send to 8 experts that gave their consent to participate in the research activity.

Electronic Questionnaire: Transaction Costs of Potential CDM

Projects developed by XXX

1) General Information on Your Companies' Potential CDM Projects

Please fill the information in the table below.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Project type						
Abatement costs (\$US/t CO ₂)						
Current stage in the project cycle						
Potential buyer						

2) Anticipated Annual Emission Reductions and Crediting Period

Please specify how much CERs you anticipate each project to generate annually. Please also give the choice of crediting period.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Emission reduction (CO ₂ e/year)						
Crediting period (years)						

3) Search Costs

Def.: Search costs are the costs that accrue to the seller and the buyer of CERs as they seek partners for a mutually beneficial exchange of CERs.

They are defined to consist of:

- Search activity costs
- Project documentation costs
- LoI costs

3.1) Search activity costs: Please outline which activities you undertake to find a buyer for the CERs potentially generated from your (clients') project(s). Please estimate for each project which costs have been spent on such activities so far and fill the figures in the table below. Please also explain which factors you would estimate such costs to depend upon.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Costs (\$US)						

Factors they might depend upon:

3.2) Project documentation costs: Please quantify the costs for the preparation of each type of documentation in the table below, if applicable. Please also estimate what they might depend upon. Finally, please also outline the procedure for obtaining the LoE.

Costs (\$US)	Project					
	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
PIN						
PCN (or similar)						
LoE						
Additional documentation						

Factors they might depend upon:

Procedure for obtaining the LoE:

3.3) LoI costs: Please specify if any potential buyer has expressed his intention to purchase CERs from any of your (clients') projects in the form of a Letter of Intent (LoI). If so, please indicate for which project and please briefly outline the procedure

involved in negotiating and signing the LoI. Can one expect significant costs to accrue from that procedure (e.g. *travel costs, negotiation and decision-making costs, etc*)? If so, please quantify them.

--

4) Negotiation Costs

Def.: Negotiation costs are the costs that arise when potential sellers and buyers negotiate the terms of the ERPA on the basis of the LoI.

Please specify for which projects you (or your client(s)) engaged into negotiation of an Emission Reduction Purchase Agreement (ERPA), if any, and what has been the procedure and the involved costs. Please also explain which factors you would estimate such costs to depend upon.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Costs (\$US)						

Factors they might depend upon:

--

5) PDD Costs

Def.: PDD costs are the costs that accrue from the tasks that have to be undertaken in order to complete the PDD as laid down in the CDM rules.

PDD costs are defined to consist of:

- A) Baseline determination costs
- B) Monitoring plan determination costs
- C) Costs for analysis of environmental impacts of the project
- D) Costs for stakeholder consultation
- E) Other (e.g. *project description, calculation of GHG emissions, etc*)

5.1) Please give the costs for A), B), C), D) and E) for each project in the table below.

If you have not yet completed the PDD for each project, please estimate the likely costs and mark them with “est.”.

Costs (\$US)	Project					
	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
A)						
B)						
C)						
D)						
E)						

5.2) If you cannot specify the PDD cost components for all projects please give an average cost estimate of the cost components A), B), C), D) and E) and please briefly outline on which factors they might depend upon (*Was there any noteworthy difference in the costs among the different project types? If so, among which and why?*).

A)	
B)	
C)	
D)	
E)	

Factors they might depend upon:

--

5.3) Please specify if any of the projects are eligible under the CDM small-scale rules and if you (plan to) use those rules for your (clients') project(s). Do you estimate the PDD costs to be lower for the project(s) in question than with a non-small-scale project of the same kind?

--

6) Approval Costs

Def.: Approval costs are the costs that the project developer faces in order to obtain host country approval.

As no official DNA is yet in place in India: Which costs do you expect to occur for obtaining such a host country approval? What do you estimate the procedure to be?

7) Validation Costs

Def.: Validation costs are the costs that the project developer has to pay to the OE for validation.

7.1) Please fill the validation costs for each project in the table below.

If you have not contracted a validator for all projects, please estimate the likely validation costs of the projects and mark them with “est.”.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Costs (\$US)						

7.2) Please specify on which factors you would estimate the validation costs to depend upon.

8) Monitoring Costs

Def.: Monitoring costs are the costs that arise from the implementation of the monitoring plan, the periodic monitoring activities and the periodic submission of the monitoring report.

As none of the projects has been implemented please estimate the monitoring costs for each project. Please distinguish between

- A) Initial capital costs (for the installation of monitoring equipment and data processing facilities)
- B) Annual monitoring costs (for collecting and processing the data as well as for completing the monitoring report)

Please only consider those costs that are additional to conventional project monitoring.

Costs (\$US)	Project					
	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
A)						
B)						

9) Verification and Certification Costs

Def.: Verification and certification costs are the costs that the project developer has to pay to the OE that performs verification and certification.

9.1) As none of the projects has been implemented please give an estimate on the likely verification and certification costs for each project in the table below. Please also specify in which intervals you plan to perform verification and certification (*e.g. annually, bi-annually, etc*). Finally, please also estimate on which factors you would expect the verification and certification costs to depend upon.

Project	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Costs (\$US)						
Intervals						

Factors they might depend upon:

9.2) Please specify if any of the projects would be eligible under the CDM small-scale rules and if you plan to contract the same OE for both validation, verification and certification. To which extent do you estimate the verification and certification costs to be lower for the project in question than with a non-small-scale project of the same kind?

Note on confidential treatment We will not use or mention the name of you or your company in our forthcoming publication. If you require us to keep any other information given by you in the above questionnaire confidential, please specify your

requirements or suggestions how to disclose information that you do not want to see circulated.

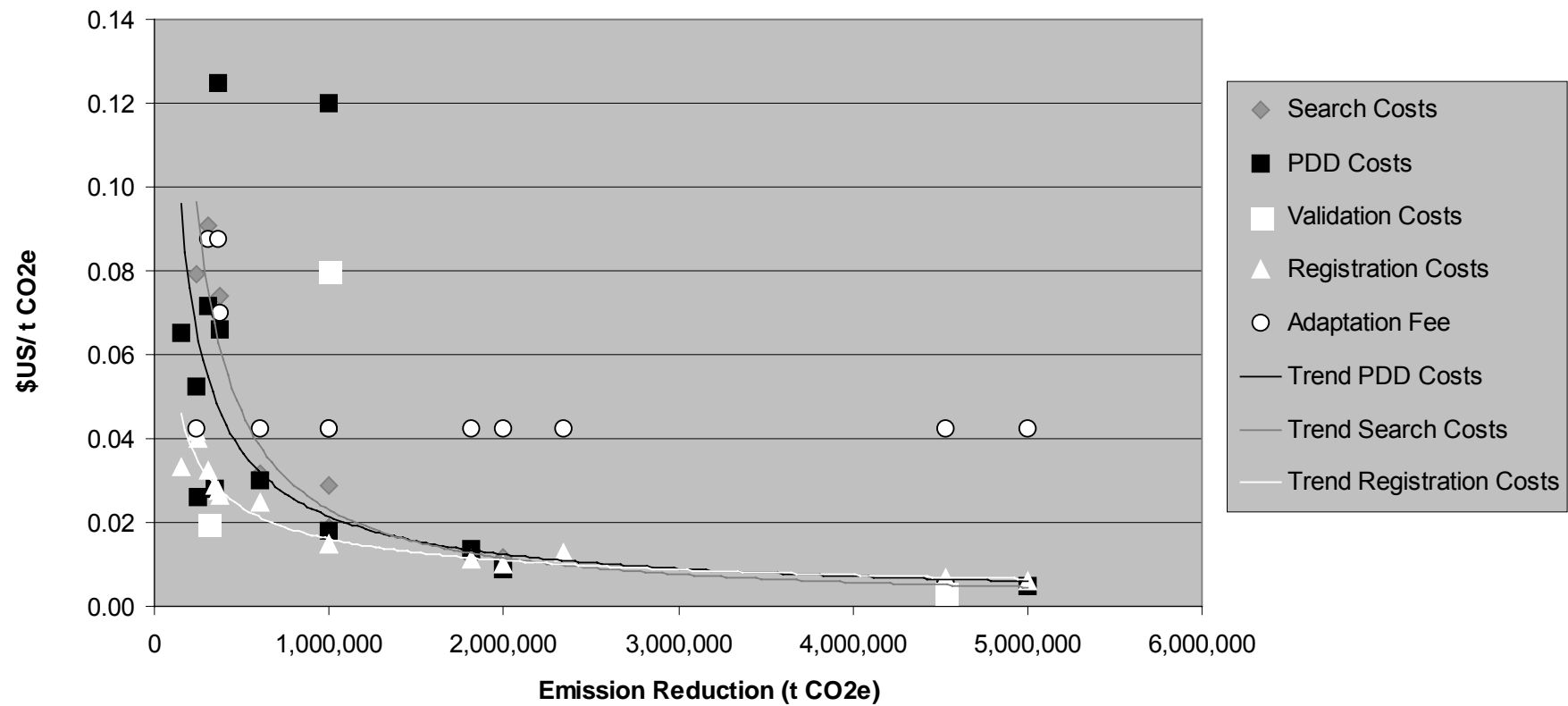
--

Thank you very much for your effort and for your valuable contribution to our research.

We will make sure that you will receive the research results based on this questionnaire as soon as possible.

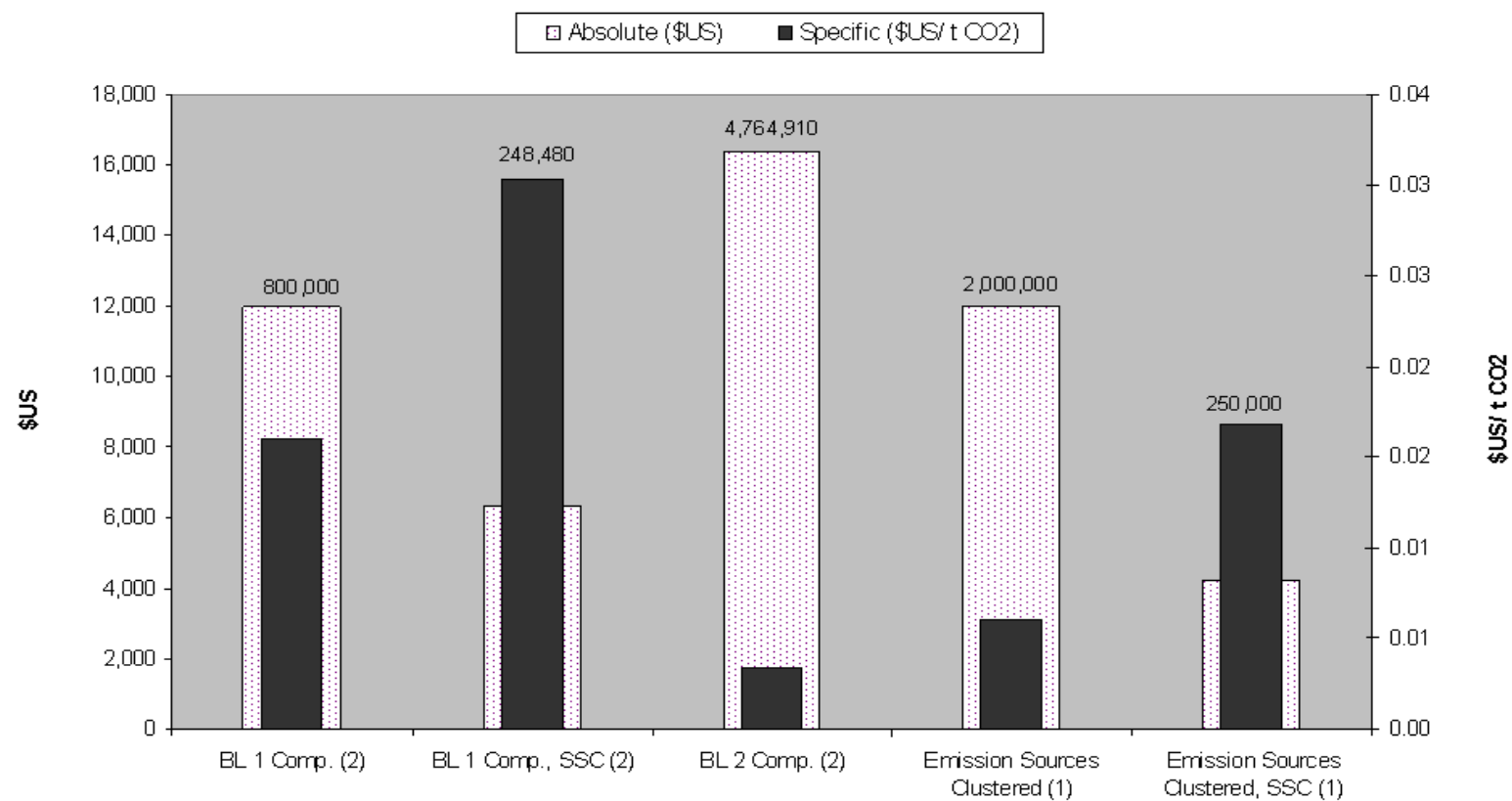
Appendix V

Specific Transaction Costs of Selected Potential CDM Projects in India by Cost Component Quantified and Their Dependence on the Projects' Emission Reduction



Appendix VI

Aggregated Baseline and Monitoring Plan Costs of Selected Potential CDM Projects in India and Their Dependence on Project Complexity



References

- ADB Asian Development Bank]/GEF [Global Environmental Facility]/UNDP [United Nations Development Programme] (1998), (eds.)
ALGAS - Asia Least-cost Greenhouse Gas Abatement Strategy, Manila
- Akumu, G. (1993)
Joint Implementation: Mitigation Strategy or Hidden Agenda?, in: Eco No. 4, p. 3
- Albritton, D.L. et al. (2001)
Climate Change 2001: The Scientific Basis (Technical Summary). Report of Working Group I, in: IPCC [Intergovernmental Panel on Climate Change] (2001) (ed.): Climate Change 2001
URL:http://www.grida.no/climate/ipcc_tar/wg1/129.htm (04.01.03)
- Arrow, K.J. (1969)
The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-market Allocation, in: The Analysis and Evaluation of Public Expenditures: The PBB-System. Joint Economic Committee 91/1(1). Government Printing Office. Washington DC
- Arts, K.; Peters, P.; Schrijver, N.; v. Sluijs, P. (1994)
Legal and Institutional Aspects, in: Kuik, O./Peters, P./Schrijver, N. (1994) (eds.): Joint Implementation to Curb Climate Change. Legal and Economic Aspects. Dordrecht–Boston–London
- Banuri, T. et al. (2001)
Climate Change 2001: Mitigation (Technical Summary).
Report of Working Group III. In: IPCC [Intergovernmental Panel on Climate Change] (ed.): Climate Change 2001.
URL:http://www.grida.no/climate/ipcc_tar/wg3/010.htm (03.06.03)
- Barret, S. (1991)
Economic Instruments for Climate Change Policy, in: OECD [Organisation for Economic Co-operation and Development] (ed.): Responding to Climate Change: Selected Economic Issues. Paris
- Baumert, K.; Kete, N.; Figueres, C. (2000)
Designing the Clean Development Mechanism to Meet the Needs of a Broad Range of Interests. Climate Notes. World Resource Institute, Washington DC
- Bosi, M. (2001)
Fast-tracking Small CDM Projects: Implications for the Electricity Sector. OECD/IEA Project for the Annex I Expert Group on the UNFCCC. Paris
- Brockmann, K.; Stronzik, M.; Bergmann, H. (1999)
Emissionsrechtehandel – Eine neue Perspektive für die Deutsche Klimapolitik nach Kioto, Heidelberg
- Buen, J. (2002)
CDM Investment. Market Actors' Perceptions.
URL:<http://www.rite.or.jp/GHGT6/pdf/H2-1.pdf> (23.03.03)

- Butzengeiger, S.; Michaelowa, A.; Bode, S. (2003)*
Europe – A Pioneer in Greenhouse Gas Emissions Trading. History of Rule Development and Major Design Elements, in: HWWA [Hamburg Institute for International Economics] (ed.): Intereconomics. Review of European Economic Policy. Vol. 38. No. 4. July/August, pp. 219-228
- Castro, M./Figueres, C. (2002)*
The Functions of a National Authority, in: C. Figueres (ed.): Establishing National Authorities for the CDM. A Guide for Developing Countries, Manitoba, pp. 63-74
- CDCF [Community Development Carbon Fund] (2003) (ed.):*
Background Information.
URL:<http://communitycarbonfund.org/router.cfm?Page=DocLib&Dtype=17>
(14.07.03)
- Chatterjee, K. (ed.) (1997)*
Activities Implemented Jointly to Mitigate Climate Change. Developing Countries Perspectives, New Delhi
- Coase, R.H. (1960)*
The Problem of Social Cost. Journal of Law and Economics, Vol 3, 1-44.
URL:<http://www.qmw.ac.uk/~ugtel33/courses/environs/coase.pdf> (03.06.03)
- Coase, R.H. (1937)*
The Nature of the Firm. Economica, Vol. 4. Pp. 386-405
URL:http://people.bu.edu/vaguirre/courses/bu332/nature_firm.pdf (03.06.03).
- DEA [Danish Energy Authority] (2003) (ed.)*
CDM Project Manual, Copenhagen, URL:<http://www.ens.dk/sw2973.asp>
(09.07.03)
- De Coninck, H. C.; van der Linden, N. H. (2003)*
An Overview of Carbon Transactions. General Characteristics and Specific Peculiarities, URL:<http://www.ecn.nl/library/reports/2003/c03022.html>
(14.03.03)
- De Gouvello, C.; Coto, O. (2003)*
Transaction Costs and Carbon Finance Impact on Small-scale CDM Projects, PFCplus Report 14, Washington DC
- Deodhar, V.; Michaelowa, A.; Krey, M. (2003)*
Financing Structures for CDM Projects in India and Capacity Building Options for EU-Indo Collaboration, HWWA Discussion Paper 247, Hamburg
- Dubash, N. (1994)*
Commoditizing Carbon: Social and Environmental Implications of Trading Carbon Emissions Entitlements. Master Thesis, Berkeley
- Dudek, D. J.; Wiener J.B. (1996)*
Joint Implementation, Transaction Costs and Climate Change, Paris
- Dutschke, M.; Michaelowa, A. (1998)*
Interest Groups and Efficient Design of the Clean Development Mechanism under the Kyoto Protocol, HWWA Discussion Paper 58, Hamburg
- EcoSecurities (2001) (ed.)*
Prototype Carbon Fund Market Intelligence Report.
URL:<http://www.ghgprotocol.org/docs/CarbonMarketIntelligenceReport.1.pdf>
(11.09.03).

- EcoSecurities (2002) (ed.)*
Clean Development Mechanism (CDM), Simplified Modalities and Procedures for Small-scale CDM, Final Report for the Department for International Development, Oxford, UK
- EcoSecurities (2003) (ed.)*
Wigton Wind Farm Project. Project Design Document Submitted to the EB for Approval of the Methodology. Final Draft April 2003.
URL:http://cdm.unfccc.int/methodologies/UserManagement/FileStorage/FS_108256551 (06.10.03)
- Ellerman, A.D.; Joskow, P.L.; Harrison, Jr. D. (2003)*
Emissions Trading in the U.S., Experience, Lessons and Considerations for Greenhouse Gases, Arlington
- Ellis, J.; Bosi, M. (1999)*
Options for Project Emission Baselines, OECD and IEA Information Paper, Paris
- Environmental Finance (2003) (ed.)*
Governments Turn to GHG Projects. Article from 03.03.03.
URL:<http://www.environmentalfinance.com/2003/0303mar/news.htm#mn8> (15.07.03)
- Fichtner, W.; Graehl, S.; Rentz, O. (2003)*
The Impact of Private Investor's Transaction Costs on the Cost-effectiveness of Project-based Mechanisms, Climate Policy, Vol. 3, Issue 3, pp. 249-259
- Fisher et al. (1996)*
An Economic Assessment of Policy Instruments for Combating Climate Change, in: J.D. Bruce et al. (eds.): Climate Change 1995, Economic and Social Dimensions of Climate Change, Contribution of Working Group III to the 2nd Assessment Report of the IPCC, Cambridge University Press, pp. 397-439
- Gonzalez, A.D.C. (2001)*
Financing Issues and Options for Small-scale Industrial CDM Projects in Asia, Bangkok
- Greiner, S. (2000)*
Flexible Instruments and Stakeholder Interests: A Public Choice Analysis, in: A. Michaelowa/M. Dutschke (eds.): Climate Policy and Development, Cheltenham-Northampton, pp. 45-58
- Grubb, M.; Michaelowa, A.; Swift, B.; Tietenberg, T.; Zhang, Z. (1998)*
Greenhouse Gas Emissions Trading, Defining the Principles, Modalities, Rules and Guidelines for Verification, Reporting and Accountability, United Nations New York-Geneva
- Haddad, B.M.; Palmisano, J. (2001)*
Market Darwinism vs. Market Creationism, Adaptability and Fairness in the Design of Greenhouse Gas Trading Mechanisms, International Environmental Agreements, Politics, Law and Economics 1, pp. 427-446
- IETA [International Emissions Trading Association] (2002) (ed.)*
Carbon Contract Cornerstones, Drafting Contracts for the Sale of Project-based Emission Reductions. Discussion Paper No. 02-01. Version 1.2.
URL:http://www.ieta.org/Documents/Discussion_Papers/IETA_discussion_paper_0201.pdf (09.05.03)

- INC [International Negotiating Committee for a Framework Convention on Climate Change] (1993) (ed.)*
Matters Relating to Commitments – Criteria for Joint Implementation, Comments from Member States on Criteria for Joint Implementation, Geneva
- INC [International Negotiating Committee for a Framework Convention on Climate Change] (1995) (ed.)*
Report of the International Negotiating Committee for a Framework Convention on Climate Change, Part Two: Recommendations to the Conference of the Parties and other Decisions and Conclusions of the Committee, Geneva
- Janssen, J. (2001)*
Risk Management of Investment in Joint Implementation and Clean Development Mechanism Projects, St. Gallen
- Janssen, J. (2002)*
Financing Industrial CDM Projects in Asean Countries, United Nations, Vienna
- JIN [Joint Implementation Network] (2003) (ed.)*
The Meth Panel Evaluation How to get it right?, in: JIN [Joint Implementation Network] (ed.): Joint Implementation Quarterly, Vol. 9, No. 2. July, Paterswolde, pp. 2-4
- JIN [Joint Implementation Network]/EPU-NTUA [Decision Support System Laboratory of the National Technical University of Athens]/CES [Centre for Environmental Strategies]/HWWA [Hamburg Institute for International Economics]/UNICARL-DFIU [French-German Institute for Environmental Research at the University of Karlsruhe]/Factor GmbH (2003) (eds.):*
PROBASE – Procedures for Accounting and Baselines for Joint Implementation and Clean Development Mechanism Projects, Project Supported under the EU Fifth Framework Programme, Paterswolde
- Jones, T. (1994)*
Joint Implementation as a Policy Instrument for Responding to Climate Change, Paper presented to IPCC Working Group III, Workshop on Policy Instruments and Their Implications, 17-20 January, Tsukuba
- Jotzo, F. (2003)*
CDM and the Additionality Question, in: AETF [Australia Emissions Trading Forum] (ed.): AETF Review. Aug/Sept. pp. 4-5
- Jotzo, F.; Michaelowa, A. (2002)*
Estimating the CDM Market under the Marrakech Accords. Climate Policy, Vol. 2, Issue 2-3, pp. 179-196
- Jung, M. (2003)*
The Role of Forestry Sinks in the CDM, Analysing the Effects of Policy Decisions on the Carbon Market, HWWA Discussion Paper 241, Hamburg
- Kartha, S.; Lazarus, M.; Bosi, M. (2002)*
Practical Baseline Recommendations for Greenhouse Gas Mitigation Projects in the Electric Power Sector, OECD and IEA Information Paper, Paris
- Kerr, S.; Maré, D. (1997)*
Transaction Costs and Tradable Permit Markets, The United States Lead Phase Down, Paper presented for the EAERE Conference Tiburg, The Netherlands, 26-28 June

- KfW [Kreditanstalt für Wiederaufbau] (2001) (ed.)*
 Derzeitiger Stand der Kyoto-Instrumente CDM und JI und die mögliche Rolle der Banken bei ihrer Umsetzung, Diskussionsbeiträge, Nr. 27, Frankfurt a. M.
- Klaassen, G.; Nentjes, A. (1997)*
 Sulfur Trading under the CAAA in the US: An Assessment of the First Experiences, *Journal of Institutional and Theoretical Economics*, 153 (2). Pp. 384-410
- Kopp, O.; Bräuer, W. (1998)*
Entwicklungschancen und Umweltschutz durch Joint Implementation mit Indien, Mannheim
- Langrock, T.; Michaelowa, A.; Greiner, S. (2000)*
 Defining Investment Additionality for CDM Projects – Practical Approaches, HWWA Discussion Paper No. 106, Hamburg
- Markandya, A. et al. (2001)*
 Costing Methodologies, in: B.Metz et al. (eds.): *Climate Change 2001, Mitigation. Contribution of Working Group III to the 3rd Assessment Report of the IPCC*, Cambridge University Press, pp. 451-498
- Michaelowa, A. (1995)*
 Internationale Kompensation: Eine Chance für den Klimaschutz, *Wirtschaftsdienst* Nr. 5, pp. 259-266
- Michaelowa, A. (1997)*
 Internationale Kompensationsmöglichkeiten zur CO₂-Reduktion unter Berücksichtigung steuerlicher Anreize und Ordnungsrechtlicher Maßnahmen, Baden-Baden
- Michaelowa, A. (2000)*
 Flexible Instruments of Climate Policy, in: A.Michaelowa/M. Dutschke (eds.): *Climate Policy and Development*, Cheltenham-Northampton, pp. 1-39
- Michaelowa, A. (2001a)*
 Rio, Kyoto, Marrakesh – Groundrules for the Global Climate Policy Regime, HWWA Discussion Paper 2001, Hamburg
- Michaelowa, A. (2001b)*
 Kompensationslösungen, in: W. Schulz et al. (eds.): *Lexikon Nachhaltiges Wirtschaften*, München, pp 171-178
- Michaelowa, A. ; Stronzik, M. (2002)*
 Transaction Costs of the Kyoto Mechanisms, HWWA Discussion Paper 175, Hamburg
- Michaelowa, A.; Butzengeiger, S.; Bode, S. (2003)*
 Bestimmung von Referenzfall und Zusätzlichkeit bei CDM-Projekten, in: *UmweltWirtschaftForum* (ed.). September
- Michaelowa, A.; Schmitz, S. (2003)*
 Baseline Determination at Government Discretion, Multi-project Baselines for the First Track of Joint Implementation?, HWWA Discussion Paper 229, Hamburg
- Missfeldt, F.; Fenhann, J.; Olivier, A.L. (2002)*
 Analysis of Simplified Modalities and Procedures for Small-scale CDM Projects under the UNFCCC, UNEP CCEE Working Paper No 12, Risø

- MoFA [Ministry of Foreign Affairs, Government of Finland] (2003a)*
Finnish CDM/JI Pilot Programme: New.
URL:<http://global.finland.fi/english/projects/cdm/new.html> (14.07.03)
- MoFA [Ministry of Foreign Affairs, Government of Finland] (2003b)*
Clean Development Mechanism (CDM) and Joint Implementation (JI) Pilot Programme, Operational Guidelines.
URL:http://global.finland.fi/english/procurement/kyoto/annex5_guidelines.pdf (14.07.03)
- MoEF [Ministry of Environment and Forests, Government of India] (2002a)*
Clean Development Mechanism. Interim Approval Criteria.
URL:http://envfor.nic.in:80/divisions/ccd/cdm_iac.html (25.02.03)
- MoEF [Ministry of Environment and Forests, Government of India] (2002b):*
Projects Endorsed for Further Development by Government of India.
URL:<http://envfor.nic.in:80/cc/cdm/endorsed.htm> (25.02.03)
- Montgomery, D.W. (1972)*
Markets in Licenses and Efficient Pollution Control Programmes, *Journal of Economic Theory* 5(3), pp. 395-418
- Moomaw, W.R. et al. (2001)*
Technological and Economic Potential of Greenhouse Gas Emissions Reduction., in: B. Metz et al.(eds.): *Climate Change 2001, Mitigation, Contribution of Working Group III to the 3rd Assessment Report of the IPCC*, Cambridge University Press, pp. 167-300
- Narayanan, A. (2003)*
CDM and Project Financing for Renewables and Other Areas, Presentation held at the India Energy Meeting on Climate Change and CDM on 27-28 January at New Delhi, India
- Oberheitmann, A. (1999)*
Some Remarks on Additionality and Incentives in Activities Implemented Jointly, Joint Implementation and the Clean Development Mechanism, RWI Papiere No. 59, Essen
- OECD [Organisation for Economic Co-operation and Development] /IEA [International Energy Agency] (2002) (eds.)*
Dealing with Climate Change. Policy and Measures in IEA Member Countries, Paris
- OECD [Organisation for Economic Co-operation and Development] /IEA [International Energy Agency] (1997) (eds.)*
Activities Implemented Jointly, Partnerships for Climate and Development, Paris
- Palmisano, J. (1996)*
Air Permit Trading Paradigms for Greenhouse Gases: Why Allowances Won't Work and Credits Will, Discussion Draft (Personal View), Enron Europe Ltd., London
- Parikh, J. (1994)*
Role of Markets, Governments and International Bodies in Joint Implementation with the South, in: S. Kilparti (ed.): *Criteria for Joint Implementation under the Framework Convention on Climate Change*, Woods Hole Research Center, pp. 15-24

- PCF [Prototype Carbon Fund] (2002a) (ed.)*
What Goes Into a Good PIN and a PCF Project?, Presentation at the PCF Training Workshop on Project Formulation under the Clean Development Mechanism from 30 September - 2 October at Hanoi, Vietnam
- PCF [Prototype Carbon Fund] (2002b) (ed.)*
Carbon Contracts. The PCF Experience.
URL:<http://prototypecarbonfund.org/router.cfm?Page=PCFPOutreach> (03.05.03)
- PCF [Prototype Carbon Fund] (2003a) (ed.)*
An Overview.
URL:<http://prototypecarbonfund.org/router.cfm?Page=Overview> (14.07.03).
- PCF [Prototype Carbon Fund] (2003b) (ed.)*
The PCF and IDFC Pioneering Greenhouse Gas Reductions in India, Presentation held at the India Energy Meeting on Climate Change and CDM on 27-28 January at New Delhi, India
- PCF [Prototype Carbon Fund] (2003c) (ed.)*
Durban, South Africa, Landfill Gas to Electricity. Project Design Document Submitted to the EB for Approval of the Methodology, Final Draft 15.04.03, URL:http://cdm.unfccc.int/methodologies/UserManagement/FileStorage/FS_3464599 (07.10.03)
- PCF [Prototype Carbon Fund] (2003d) (ed.)*
List of Projects.
URL: <http://prototypecarbonfund.org/router.cfm?Page=ProjList> (14.07.03)
- Pearce, D. (1995)*
Joint Implementation, A General Overview, in: C.J. Jepma (ed.): The Feasibility of Joint Implementation, Environment & Policy, Vol. 3, Dordrecht-Boston-London, pp. 15-32
- Point Carbon (2002) (ed.)*
Is there a Business Case for Small-scale CDM Projects?, Lysaker
- Point Carbon (2003a) (ed.)*
CDM: A Three-year Forecast Lysaker
- Point Carbon (2003b) (ed.)*
Viewpoint: What Price for EU Allowances, in: Point Carbon (ed.): Carbon Market Europe, April 25, URL:<http://www.pointcarbon.com/article.php?articleID=2181> (27.04.03)
- PWC [PriceWaterhouseCoopers] (2000) (ed.)*
A Business View on Key Issues Relating to the Kyoto Mechanisms, London
- Richter, Rudolf; Furubotn, Eirik G. (1999)*
Neue Institutionenökonomik: Eine Einführung und kritische Würdigung, 2. Auflage, Mohr Siebeck, Tübingen
- Rosenzweig, R.; Varilek, M.; Feldman, B.; Kuppalli, R.; Janssen, J. (2002)*
The Emerging International Greenhouse Gas Market. Arlington.
- Roy, J.; Das, S. (2001)*
Potential Multi-project Baselines in the Power Sector in the Eastern Region of India, LBNL-48242C., in: J. Sathaye/L. Price/E. Worrell/M. Ruth: Multi-project Baselines for Evaluation of Industrial Energy-Efficiency and Electric Power Projects LBNL-48242, pp. C1-C13

- Schröder, H. (2001)*
Negotiating the Kyoto Protocol, An Analysis of Negotiation Dynamics in International Negotiations, Münster-Hamburg-London
- Senter (2001) (ed.)*
Terms of Reference. CERUPT 2001.
URL:<http://www.senter.nl/asp/page.asp?id=i000008&alias=erupt> (14.07.03)
- Senter (2002) (ed.)*
General Information.
URL:<http://www.senter.nl/asp/page.asp?alias=erupt&id=i001003#HowdoesCCwork> (14.07.03)
- Senter (2003) (ed.)*
Contracted Projects.
URL:<http://www.senter.nl/asp/page.asp?id=i001337&alias=erupt> (14.07.03)
- Sharma, S. (2003)*
India, in: World Bank (ed.): Capacity Building for the Kyoto Protocol, Country Survey Reports under the Program of National CDM/JI Strategy Studies, pp. 1-8
- Shukla, P.R. (2002)*
Climate Change and Sustainable Development, The Case of India, Presentation for the International Expert Meeting on Climate Change and Sustainable Development, November 19-20, Ahmedabad
- Spalding-Fecher, R. (2002) (ed.):*
The CDM Guidebook, Cape Town
- Stavins, R.N. (1995)*
Transaction Costs and Tradable Permits, Journal of Environmental Economics and Management, Vol. 29, pp. 133-148
- Stewart, R.; Anderson, D.; Aslam, M.A.; Eyre, C.; Jones, G.; Sands, P.; Stuart, M.; Yamin, F. (2000)*
The Clean Development Mechanism, Building International Public-private Partnerships under the Kyoto Protocol, Technical and Financial Issues, United Nations., New York-Geneva
- Tangen, K. (2003)*
Carbon Trading: Prospects and Drivers, Presentation at the Seminar of the International Emissions Trading Association at SBSTA, 18 June, Bonn
- TERI [Tata Energy Research Institute] (2001) (ed.)*
Clean Development Project Mechanism Opportunities in India, New Delhi
- Tietenberg, T.; Grubb, M.; Michaelowa, A.; Swift, B.; Zhang, Z. (1999)*
International Rules for Greenhouse Gas Emissions Trading: Defining the Principles, Modalities, Rules and Guidelines for Verification, Reporting and Accountability, United Nations, New York-Geneva
- Trexler, M.C.; Kosloff, L.H. (1998)*
The 1997 Kyoto Protocol: What Does It Mean for Project-based Climate Change Mitigation?, Mitigation and Adaptation Strategies 3(1), pp. 1-58
- UNFCCC [United Nations Framework Convention on Climate Change] (1992) (ed.)*
The United Nations Framework Convention on Climate Change, Geneva
- UNFCCC [United Nations Framework Convention on Climate Change] (1995) (ed.)*
Report of the Conference of the Parties on Its First Session, Part Two: Action Taken by the Conference of the Parties, Geneva

- UNFCCC [United Nations Framework Convention on Climate Change] (1997) (ed.)*
Kyoto Protocol to the United Nations Framework Convention on Climate Change, Geneva
- UNFCCC [United Nations Framework Convention on Climate Change] (2001) (ed.)*
Report of the Conference of the Parties on Its Seventh Session, Part Two: Action Taken by the Conference of the Parties, Geneva
- UNFCCC [United Nations Framework Convention on Climate Change] (2003a) (ed.)*
Executive Board of the Clean Development Mechanism, Clean Development Mechanism Project Design Document, Version 01.
URL:<http://cdm.unfccc.int/Reference/Documents/cdmpdd/English/cdmpdd.pdf> (21.07.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003b) (ed.)*
Executive Board of the Clean Development Mechanism, Eleventh Meeting Report, URL:<http://cdm.unfccc.int/EB/Meetings/011/eb11rep.pdf> (21.11.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003c) (ed.)*
Executive Board of the Clean Development Mechanism, Designated National Authorities. URL:<http://cdm.unfccc.int/DNA> (07.10.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003d) (ed.)*
Executive Board of the Clean Development Mechanism, Sixth Meeting, Report, URL:<http://cdm.unfccc.int/EB/Meetings/06/eb06rep.pdf> (21.07.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003e) (ed.)*
Executive Board of the Clean Development Mechanism, Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-scale CDM Project Activity Categories, Annex 6 to the Seventh Meeting Report of the EB. URL:<http://cdm.unfccc.int/EB/Meetings/07/eb07ra06.pdf> (21.07.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003f) (ed.)*
National Communications from Parties not Included in Annex I to the Convention, URL:<http://unfccc.int/resource/webdocs/2002/09.pdf> (07.10.03)
- UNFCCC [United Nations Framework Convention on Climate Change] (2003g) (ed.)*
Activities Implemented Jointly under the Pilot Phase, AIJ Project Search Form. URL:http://maindb.unfccc.int/aij/?command=search&host=101&investor=&host_region=&proj_type=&title= (30.03.03)
- Vajpayee, A. (2002)*
Speech of Prime Minister Shri Atal Bihari Vajpayee at the High Level Segment of the Eighth Conference of the Parties to the UNFCCC, New Delhi
- Vrolijk, L.; Grubb, M. (2000)*
Quantifying Kyoto: How will COP6 Decisions Affect the Market?, Report of the Quantifying Kyoto Workshop, 30-31 August, The Royal Institute of International Affairs (RIIA), London
- Walsh, M. (2000)*
Simplified CDM, Working Paper, Chicago

White, K.S. et al. (2001)

Climate Change 2001: Impacts, Adaptation and Vulnerability, Report of Working Group II, in: IPCC [Intergovernmental Panel on Climate Change] (ed.): Climate Change 2001.

URL:http://www.grida.no/climate/ipcc_tar/wg2/055.htm (04.01.03)

Woerdman, E. (2001)

Emissions Trading and Transaction Costs: Analyzing the Flaws in the Discussion, *Ecological Economics* 38, pp. 293-304

Woerdman, E. (2002)

Implementing the Kyoto Mechanisms: Political Barriers and Path Dependence, Groningen

Yahoo (2003)

Wechselkurse. URL:<http://de.finance.yahoo.com/m3> (25.10.03)