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Transaction Costs and Carbon Finance Impact on Small-Scale CDM Projects

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CDM Transaction Costs
and Carbon Finance Impact
on Small CDM Energy projects

Road testing Simplified Procedures
on a Real Rural Energy Project

Christophe de Gouvello

Oscar Coto

**"Potential Impact of carbon finance
on Very Small Renewable Projects in Rural Off-Grid Areas
Analysis, Recommendations for Simplified Procedures**

Paris, November 2002

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Executive summary:

The purpose of this study is twofold. The first objective aims at examining under which conditions the transaction costs associated with the Clean Development Mechanism (CDM) process can become significantly lower than the carbon revenue expected from for small clean energy projects. The second one aims at analyzing the impact of carbon finance on the economics of such projects.

For this purpose, the first version of the simplified CDM procedures for small scale CDM projects has been road-tested on a real rural energy project in Guatemala, the Chel project (micro-hydro). Since the Executive Board of the CDM has not already adopted the final simplified procedures for small scale projects, different options have been tested, for which detailed transaction costs have been analyzed. As a first step, we calculated them. In a second step, we compared it to the carbon revenue. In a third step we made a sensitivity analysis against carbon prices and discount rates variations. And in a fourth step we explored the role of carbon finance as a means to reduce the relative weight of transaction costs.

As a result of the first step, it appears that the main component of transaction costs is the price to be charged to the project developer by the operational entity (OE), whichwill be in charge of the validation and the verification-certification stages. If the OE charges "international rates" (about USD 1,000 per day), the corresponding cost can rise to USD 70,000 , that is, 90% of the total transaction costs (USD 78,058). But if the OE charges only "local rates" (about USD 200 per day) and assuming that the procedures are also further simplified in order to reduce recurrent tasks to be done by OE, the OE cost falls to USD 3,800, that is, 46,5% of the total transaction costs of the most simplified option (USD 8,168).

Then, in a second step, we compare these transaction costs to the carbon revenue that this project may earn if it qualifies for CDM. We also analyzed the sensitivity of the relative weight of the transaction costs compared to the carbon revenue against (a) the carbon prices and (b) the discounted rate used to calculate the present values of both.

Both of these results stress that the main challenge of reducing global transaction costs for small projects relies on reducing the OE cost. This cost can be reduced either by limiting the recurrent tasks of the OE (i.e. opting for multi-annual rather than annual verification), or by promoting the accreditation of low cost OEs, typically by accrediting Developing Countries' firms charging "local" rates.

Another way to lower the transaction costs for small CDM projects still more, although less effective,is to simplify as much as possible the Project Design Document (PDD), in order to make it easier for the project developer to complete it alone, and thus reducethe need to hire local consultant.

In a third step, we explore how carbon finance may also be a means of reducing the relative weight of transaction costs, by using the discount rate as a way of modeling. In fact the discount rate can be interpreted as representing the financial conditions offered by the carbon financer to the project developer. This is especially clear when the carbon financer agees to finance an up-front purchase of the Certificates of Emissions Reductions (CERs) that will be generated during the crediting period. In that case, the discount rate represents the interest rate used to calculate the up-front payment corresponding to the present value of the future CERs.

The result of this examination shows that offering carbon finance under very favorable conditions for both the purchase of CERs and the financing of transaction costs seems to be an efficient way to reduce the relative burden of transactions costs for small scale projects

when (i) recurrent costs (monitoring, verification and certification) have been reduced to the minimum (i.e. option a), and (ii) carbon price are low. This way the relative weight of transaction costs can be lowered from 66% of CERs present value for a discount rate of 18% to 37% for a discount rate of 3%, assuming a carbon price of USD 5.00/tC02.

For the second purpose of the study - to analyze the potential impact of carbon finance on small, clean energy projects - we analyzed some of the constraints that limit the feasibility of small, clean projects and how carbon finance may help to overcome them. Here, we considered the potential impact of the carbon revenue, looking at the ways carbon finance may help to channel it.

The main findings are that the carbon finance may help to release the constraint on investment cost financing, either by participating directly through an up-front payment, or by helping to increase the share of private equity, or by facilitating access to commercial loans. Carbon finance may also help to sustain over the long term certain small energy projects that are not able to generate the resources necessary to cover O&M costs (typically energy systems for isolated rural health centers or schools).

The analysis is illustrated by two case studies presented in annexes. Annex 2 synthesizes a study that assessed the relative share of initial project cost that the carbon revenue can represent in the case of a large, decentralized rural electrification project (15,000 households). And Annex 3 presents the results of business plan simulations for the E7 Tahumanu Project in Bolivia (mini-hydro), analyzing the recycling of the carbon revenues to increase private contribution in equity.

I.   Introduction :

This study has two main objectives:

1) to assess transaction costs of applying CDM simplified modalities and procedures for small scale projects, by road testing it on a real projectm
2) to explore more generally the impact of carbon finance on small energy projects, taking into account transaction costs.

The study is structured in four parts. In the first part we analyzed the different determinants of the carbon revenue, that is, the choice of the baseline, the carbon price forecasts and the transaction costs associated with the CDM procedures.

In the second part, we calculated in detail the transaction costs of a real small-scale project by road-testing the simplified CDM procedures on the Chel project, a small rural energy project in Guatemala.

Then we compared these transaction costs to the carbon revenue that this project may earn if it qualifies for CDM. For this purpose, we analyzed the sensitivity of the relative weight of the transaction costs compared to the carbon revenue against the carbon prices and the discounted rate used to calculate the present values of both.

The fourth part analyzes the possible impact of the carbon finance on small, clean energy projects. The discussion is illustrated by two case studies presented in annex 2 and 3.

II.   Carbon Revenue and Transaction Costs of CDM projects: a review

The potential impacts of carbon finance on CDM projects are not likely to change qualitatively regardless of whether the projects are large or small.

What is more likely is that the relative importance of the different impacts will not be the same, certain impacts being potentially equal to zero for small projects, if transaction costs are too high, while remaining attractive for large projects.

The potential impact of carbon finance on CDM projects depends on various factors:

- the carbon revenue that will be generated as a result of the participation of the project in the CDM.
- how this carbon revenue will be perceived and used by the project participants, with the possible assistance of institutions specialized in carbon finance.

Very simply, the carbon revenue of a CDM project can be calculated as a function of 3 parameters:

$CR = V * P - T$

Where:

- V is the volume of CERs awarded to the project
- P is the market price of CERs
- T is the transaction costs associated with the CDM process and the valuation of the awarded CERs

Although our main purpose here is the transaction costs, it is important to mention the significant variability of the two other variables (i.e. V, the volume of CERs earned, and P, the market price of carbon), particularly because part of the transaction costs are proportional to the market value of CERs (namely the administrative and adaptation levies), but also because we intend to compare transaction costs to the value of CERs.

II.1 The Baseline Methodology as a Determinant of the Carbon Revenue

The volume of CERs granted to the project, depends mainly on the way the baseline is determined. According to Jackson et al., whose conclusions are based on the analysis of five JI projects, the uncertainties arising from the determination of the baseline are far greater than those deriving from project-performance and measurement uncertainties. (see Jackson and alii, 2001)[1].

In the case of small scale projects, the first draft of standardized baseline methodologies was produced by the SSC panel and submitted for public comments in August 2002. While some changes may still occur in these methodologies before their adoption by the Executive Board, we used them for a first simulation to determine the potential volume of CERs that the Chel project may receive. And when we try to apply these draft methodologies to the Chel project we found that several methodologies could be chosen. As a result,the volume of calculated emissions reductions for this project could vary as much as 26 percent : calculation using Category A project methodology would lead to an increase of 26 percent of CO_2 savings estimates, compared to the result using the Category D project methodology (see box n°1). The new methodologies list that will likely be approved in 2003 by the Executive Board may still include different options for this type of project, leading to different potential standardized baselines and emission reduction values.

For further calculations, we used the most conservative value, that is the one calculated using Category D, that is 204 tCO_2/y.

We present also in Annex 1 a case study on decentralized rural electrification, published in de Gouvello et al. (2002)[2], using photovoltaics, for which calculations have been made using two different baselines methodologies, one we will call the "GEF baseline" and the other the "CDM baseline[3]". This study shows that the difference in baseline methodologies can lead to a difference of more than 100% in the estimate of emission reductions.

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1 Jackson, T.; Begg, K.; Parkinson, S. "Flexibility in Climate Policy: Making the Kyoto mechanisms work", Earthscan Publications Ltd, 2001, 236 p.

2 de Gouvello, Ch. (2002) "RDE at the time of international negotiations on climate change", in "Decentralized Rural Electrification : Techniques for the Planet, a chance for Men", edited by Ch. de Gouvello and Maigne, Y., published by ADEME, CNRS, EDF and CNRS, 425 p. , chapter I.4 pp 57- 85, October 2002.

3 Here the expression "CDM baseline" designs only a possible interpretation and application of art.12 text in the Kyoto Protocol that may be adopted by the Executive Board.

Box n°1:

We faced certain difficulties in identifying the simplified methodology that could apply to the Chel project in the first draft of simplified modalities and procedures published in August 2002 for public comment. Two different methodologies, A and D, could be selected among the list of methodologies proposed for Type I projects presented in Annex B, but both present some difficulties :

Category A applies only *to "renewable technologies that supply an <u>individual household or user</u> with a small amount of electricity."*

Category D applies *to "renewables ... that supply electricity to a system that includes <u>at least one fossil fuel fired generating unit."</u>* The idea behind this specification is that, if a fossil fuel fired generating unit was used to supply in electricity the considered system under consideration and is being displaced by the proposed project activity, it would serve to calculate the baseline.

Such ambiguity may be corrected in the future version of SSC methodologies to be adopted be the EB.

As a result, the Chel project doesn't exactly fit in either of these two categories, since the Chel minigrid system doesn't include any fossil fuel fired generating unit nor does it supply only one individual household or user.

In the case of the Chel project, it seems that the results are not the same if using one or the other baseline methodology

	nb users	W installed capacity	Carbon dioxide equiv. Savings (kg CO2 eq/year) calculated using the Table B-1 Formula
Category A*	500	110 000	257 500

* We considered that the fixed value of 75 kg/y should be multiplied by the number of families participating to the project. But the methodology exposed in the Annex B is not clear regarding this point.

	Emission Factor Minigrid 24 h Service (135-200kW) (Table B-4, in kg CO2 eq/kWh)*	Daily production (projection, kWh/day))	nb of operating days per year	Carbon dioxide equiv. savings (kg CO2 eq/year) calculated using the Table B-4 values
category D	0,9	640	355	204 480

* The installed capacity of the Chel project is 110 kW, that is less than 135 kW but more than 100 kW.

II.2 High variability of prices forecasts

One should distinguish among (i) Emission Reductions prices that different programs have paid in a recent past or are currently paying (see table n°1) and (ii) price forecasts regarding the 2008-2012 period, even if theoretically both are supposed to be linked. The first are presented in table n°1:

Table n°1: Emission Reduction Prices

Programme	Price per ton of CO_2
PCF	Between 3-4 USD Average price about 3.15 USD
ERUPT for JI (prices paid under Programme in 2000)	Between 5 – 9 USD
ERUPT 3rd Tender	Between 5-5,5 USD
CERUPT (for CDM)	Up to a maximum of 5.50 USD

Source: Danish Energy Agency, 2002. PCF, 2002

Regarding price forecasts for the first commitment period, the range is still very large; it mainly depends on assumptions regarding the way Economies in Transition (EITs), who hold a huge volume of hot air, will behave on the market.

In a recent pre-simulation exercise, the broker Natsource points out price forecasts varying from 0 to 45 USD/tCO2 in 2010 (Natsource, July 2002). Whereas Hourcade and Ghersi indicate a price range varying from 15 to 100USD/tC, that is from 4 to almost 30 USD/tCO_2, from pre-simulations made on 12 different price models (Hourcade and Ghersi, 2002).

In the sensitivity analysis we will present below, we used a range of tCO2 prices varying from 1 to 35 USD/$tC0_2$.

II.3 Transaction Costs Associated to the CDM Process: Estimates Found in the Literature.

The main transaction costs categories associated to the CDM process are:

* **preparation of the PDD**, including baseline setting, consultation of stakeholders, elaboration of MVP, etc. The Executive Board has announced in his first report to COP8 his intention to elaborate a simplified PDD for SSC projects.

* **remuneration of one or several Operational Entities** (for validation and for verification). SSC projects may be allowed to hire a single OE for all the steps requiring an OE.

* **monitoring costs** during the crediting period

Estimates of transaction costs associated to the CDM process can be found in the literature.

Although these estimates are not focusing specifically on Small Scale projects, and are often not very detailed, we present below a selection of these estimates. We present also other published estimates in Annex 3.

The different estimates presented in table n°2 are also presented in the figure n°1.

One can clearly see that all type of projects can not be considered under the same category when analyzing transaction costs. For small-scale projects simplification of modalities and procedures really impacts on transaction costs estimates, leading to a range varying between USD 8,000 and USD 80,000, when the estimates for normal procedures applied on complex projects range from USD 100,000 to USD 1,100,000.

Table 2: Overview of Transaction Costs Estimates for CDM
      (Estimates collected by SSC Panel and presented in "Responses by the SSC Panel related
      to its terms of reference)

Studies	Estimated CDM Transaction Costs	Assumptions
PWC (2000)	- US$ 0.4m to $1.1m, i.e. representing between 2-23% of capital expenditures. (e.g. In the case of 0.1 MW PV project, involving only 1 operational entity, CDM-related transaction costs amount to $387,000)	- Total costs <u>over project cycle</u> (in 2000$) - Range depends on project size & type and number & nature of operational entities involved.
Walsh (2000)	- $40,000 (highly simplified project) to more than $80,000. Complex projects: $100,000 to $500,000. - Subsequent annual reporting and occasional auditing costs: 10-20% of initial costs.	- Includes <u>initial</u> costs of defining a CDM project, establishing the baseline, documenting project additionality, preparing registration forms, obtaining certification, government approval and submitting required documents - Assumes a blend of industrialised country and developing country professional fees
EcoSecurities Ltd. (2000)	- Total up-front costs: $57,000-$90,000. - Monitoring and verification: $3,000 – $15,000 per year	- Estimated costs of transacting a <u>JI</u> project, assuming JI requirements are similar to CDM project cycle.
PCF	- total costs: $200,000 - $400,000	- half of the amount for baseline work; half for verification/certification work throughout the project
Martens et al. (2001)	- Transaction costs for small-scale solar home systems projects range around 20% of the total CER revenues, using a standardised baseline & streamlined procedures.	- Without the standardised baselines and streamlined procedures, project design costs could be almost 3 times higher and total transaction costs 50% higher.
Industry Quotes	Baseline & carbon assessment	$18,000
	Validation	$28,000
	Registration	$4,000
	Carbon transaction	$17,820
	Verification	$20,000
	Certification	$500

Source: Missfeldt, Fenhann, and Olivier (2001) and reprinted from Bosi (2001), p.10.

Figure n°1:

Estimates of Transaction Costs associated to CDM Procedures and Modalities:
Simplified Modalities for Small Projects and Normal Procedures for Complex Projects
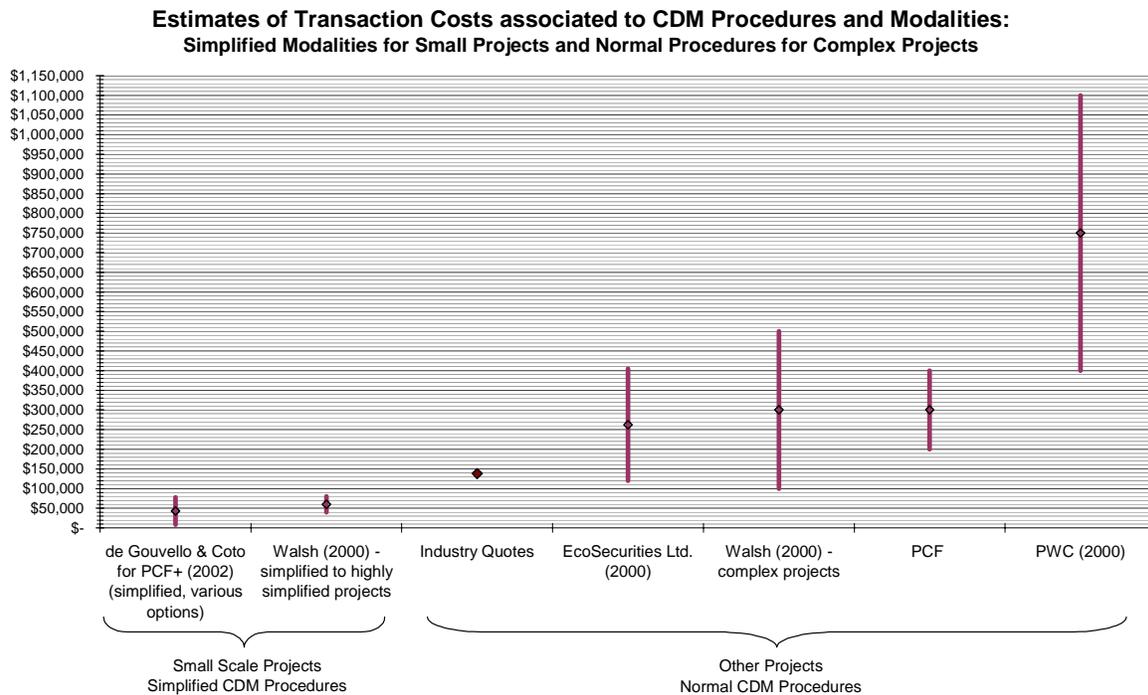
III. Analysis of the Transaction Costs associated to Simplified Modalities for Small Scale CDM Projects – The Case of the Chel Project in Guatemala

Two types of transaction costs should be differentiated:

- **the monetary costs**, which are all costs generated by the additional services that are necessary to meet the requirements of the participation to CDM process. These services may be carried out by the project developer himself, by external consultants, and by the operational entity.

- **the non-monetary costs**, which are the share of CERs corresponding to the adaptation levy, the share to be held over to the Executive Board to cover its administrative costs, and the one retained by the Host Country, if any.

Since different parameters can vary significantly, we decide to summarize the variations in two different set of hypothesis, designated below as **"option 1",** that corresponds to the lower transaction costs hypothesis, and **"option 2"**, that corresponds to the upper level of the range of transaction costs.

* Non monetary transaction costs:

We present first below the hypothesis corresponding to the non-monetary costs (table n°2):

Table n°2: hypothesis for non-monetary transaction costs

	option 1	option 2
Local CDM office and/or host country CDM retentions	0%	4%
Adaptation Levy	2%	2%
CDM administrative costs*	3%	3%
Sub Total % CERs	**5%**	**9%**

*CDM administrative costs have not yet been decided by EB. So the figure of 3% considered here is arbitrary and may be adjusted.

The difference between option 1 and 2 is due to the share of CERs retained or not by the Host Country. In fact such a possibility is agreed in principle in the Marrakech text and will have to be formalized in a sharing agreement to be transmitted to the Executive Board. At the moment Guatemala didn't take yet any official position regarding the share it may retain. For that reason we consider the possibility that small scale projects may be exempted of any retention. The value of 4% computed in option 2 is arbitrary and may be adjusted.

Such exemption is also not yet impossible regarding CDM levies (administrative costs and for the adaptation fund). If it is to be confirmed, the final estimates of transaction costs expressed below should be lowered of 5%. In such a case, non-monetary costs could become equal to zero for option 1.

* Assessment of monetary transaction cost for Small Scale CDM projects

The road testing of the simplified methodology for small scale CDM project on the Chel project has allowed us to identify the practical tasks to be done by the project developer, by a local consultant and by the operational entity, and to assess corresponding costs. Certain of these tasks have really be done for the Chel Project (for instance the preparation of the PDD), other are still speculations (for instance the tasks to be done by the OE).

We thought that the most useful way of presentation was to distinguish absolute values of the costs estimates (presented in table 6), and relative values, the latter being expressed as a percentage of the total present value of CERs earned by the project *(see Section II.1.3 Analysis of the sensitivity of transaction costs to carbon price and discount rate variations)*.

For comparison between transaction costs and CERs value, we choose to compare them on the basis of the present value of each of them, since both are spread in the time along the crediting period of the project and may occur at different points of time.

Letting aside the variation of CERs volume that can result from different baseline methodology choice, at least 2 parameters will then have still a great influence on the both the present value of CERs and transaction costs, and thus, on the relative weight of transaction costs compared to the value of CERs:

- one is of course the price of carbon, expressed in USD/tCO_2,

- the second is the discount rate used to calculate the present value of the CERs. The discount rate is also of great importance to calculate the present value of the part of the transaction costs that will be supported only in the future, typically monitoring, verification and certification costs.

For that reason we will present later the results of a sensitivity analysis that we have made in order to assess the impact of the variations of these two parameters.

We have organized the estimates of the costs according to the different steps of the process, in order to visualize the relative share of each of them.

To simplify calculations, all type of costs (overheads, etc.) has been internalized in the manpower costs estimates. The manpower costs estimates used in the calculations are presented below in table n°3:

Table n°3: Manpower cost hypothesis

monthly cost technician local Project Developer (22 days per month)	500 USD/month
monthly cost director local Project Developer (22 days per month)	1 000 USD/month
manday cost local consultant	140 USD/day
manday cost local translator	60 USD/day
manday cost "local OE"	200 USD/day
manday cost "international OE"	1 000 USD/day

We present below in table n°5 the detailed assessment of tasks to be performed, quantifying at the same time the corresponding volume of work (expressed generally in mandays), and the corresponding monetary costs that will have to be supported by the project developer.

Option 1 and Option 2 are mainly differentiated by:
- the capacity of the project developer to address alone CDM issues and administrative aspects (option 1), versus the necessity to hire a local consultant to assist him (option 2)
- the perspective of additional simplification of the procedures for small scale projects (option 1) (for instance: simplification of section C in the PDD),
- the quality of online assistance (for instance providing examples to fill the PDD),
- the stringency of local legislation regarding environmental impact assessment (taking into account only the additional reporting for the CDM process if EIA required locally),
- the necessity to formally renew (option 2) or not (option 1) the crediting period.
- the frequency of reporting for CERs issuance request

Out of option 1 and 2, it appears necessary to distinguish the cases where the Operational Entity to be hired by the project developer can be a local one (option a) or is necessary an international consultant firm (option b).

As a consequence, the final results are presented under four different options, the cheapest being **option 1.a**, and the most expensive being **option 2.b**.

We divided the assessment of the transaction costs in 4 different sections:

1. Costs deriving from the Preparation of the application to CDM:

These costs correspond mainly to the "self-learning process" any project developer would have to pass through to understand the basics of CDM (what benefits CDM can provide to him, what is exactly CERs, project cycle, etc.) how to apply and the meaning of the main concepts that appear in the PDD. This section also includes the time and efforts necessary to get the letter of approval from the host country[4]. We assume that most of these costs derive from the time the project developer will need to allocate to get the right explanation and information either from the UNFCCC CDM website, from the National CDM authority, or from a local consultant already aware of CDM procedures.

2. Filling in the PDD :

These costs derive from the tasks that need to be done either by the project developer himself, or eventually by a local consultant, to fill the PDD properly. The sum of the costs of Sections 1+2 represents the totality of the costs to be supported to prepare the application to CDM. To get the totality of the costs to be supported before the project is validated, it is still necessary to add the price to be paid to the Operational Entity who will be selected for the validation, and perhaps also the administrative costs.

3. Monitoring:

The monitoring costs derive from the different actions to be taken along the crediting period that have to be described in the Monitoring Plan. Of course, these costs have also to be supported before getting corresponding CERs.

4. Contractual arrangement with OE for validation, verification and certification

It is of the responsibility of the project developer to select the accredited OE(s) for both the validation stage and the verification-certification stage. It is also of its responsibility to negotiate with the OE(s) the contract to be sign between them, including, of course, the price that the OE(s) will charge for these tasks. It has been agreed by the EB that for small-scale CDM projects both validation and the verification-certification operations could be done by the same OE, when generally it will not be the case for other CDM projects.

It is clear that the rates charged by large international consultancy firms operating as OEs will be higher than the ones that would be charged by small local OEs located in Developing Countries, if any.

The table n°4 below presents the relative weights of these different cost categories for the two extreme configurations that we have considered (option 1.a = the most simplified procedures, and assuming that the OE will charge local rates; option 2.b = less simplified procedures, and assuming that the OE will charge international consultancy firms rates).

In both cases, the price to be paid to the OE represents the major share of the transaction costs: almost half of the total cost in case of option 1.a, and up to 90% in the case of option 2.b.

It stresses clearly that the main challenge to reduce global transaction costs for small project relies in reducing the OE cost, either by reducing the recurrent tasks to be done by

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4 We assumed here that no letter of approval from any Annex 1 country would be required, that may not be always the case, especially for large projects.

the OE (i.e. opting for multi-annual verification rather than annual ones), or by promoting the accreditation of low cost OE, typically by accrediting DCs' firms charging "local" rates.

As a second order of magnitude, and to lower still more the transaction costs for small CDM projects, it appears also important to simplify the as much as possible the PDD, in order to make it easier to be filled by the project developer alone, and thus reducing the need to hire local consultant to assist him in that task.

Table n°4: Relative share of the different transaction cost components5:

	Option 1.a *(most simplified, local OE)*	**Option 2.b** *(less simplified, international OE)*
1. To prepare the application to CDM	9,8%	1,4%
2. Filling the PDD	34,5%	4,3%
3. Annual Monitoring	9,2%	5,0%
4. Contractual arrangement with OE for validation, verification and certification	46,5%	89,4%
	100,0%	100,0%

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5 Calculated on the basis of non-discounted values.

Table n° 5: Detail of Transaction costs calculations for a Small Scale project applying to CDM Simplified Procedure
(the case of the rural hydro energy Chel Project -Guatemala)

1. Costs deriving from the Preparation of the application to CDM

		Option 1		Option 2	
		local project developer manpower	local consultant	local project developer manpower	local consultant
1.1 Interactions with CDM National Authority		4		4	2
	Local contact with CDM national authority to get preliminary information on application procedure, on how to get letter of approval, authorization to participate, etc.				
	Section A: to understand how to fill sub-sections related to:				
	A.3 who should appear as participant				
	A.4.4 statement on how emissions will be reduced				
	A.4.5 on public funding				
	A.4.6 on bundling, debundling and multiple components issues				
	Section B: to understand how to fill sub-sections related to:				
	B.1&2: to become familiar with annex II and choose the baseline methodology				
	ex B.6 to understand the bracket content				
	F. to understand what is exactly required				
	G. to understand why and which type of public comments are required				

1.2 preliminary information to be collected

		Option 1 LPDM	Option 1 LC	Option 2 LPDM	Option 2 LC
	getting practical information of application procedure through internet with the assistance of English speaking local consultant		1		1
	Preliminary contact with carbon finance agents through the assistance of a local consultant		2		2

		local project developer manpower	local consultant
1.3 Getting the authorization to participate and the approval letter		3	1

		option 1		option 2	
		nb days PD	nb days LC	nb days PD	nb days LC
Sub total 1	**Preliminary information, interactions with National Authority, letter of approval, authorization to participate**	7 days	4 days	7 days	days
		239 USD	**560 USD**	**239 USD**	**840 USD**
		799 USD		**1,079 USD**	

2. Completing the PDD

	option 1		option 2	
	nb days PD	nb days LC	nb days PD	nb days LC
Section A General Description: in local language	2	1	2	1
Description of the project activity and technology (A.2, A.4.2, A.4.3)				
Filling A.4.4: statement on how emissions will be reduced				
Filling A.4.5 on Public Funding				
Filling A.4.6 on bundling, debundling and multiple components				
Section B Baseline Methodology: in local language	2	2	2	2
B.1 & 2 Study, understand and choose the project category and approved methodology				
ex B.4 Explaining how emissions will be reduced and why the project is not in the baseline				
ex B.5 boundary description				
Section C Crediting Period	nb days PD	nb days LC	nb days PD	nb days LC
Option 1 : assuming that section C will be simplified (same starting date for project activity and crediting period)	0,25			
Option 2 filling section C as it is				1
Section D: Monitoring plan	nb days PD	nb days LC	nb days PD	nb days LC
Filling the unique remaining table				
Option 1: assuming that an example is available	1	1		
Option 2: assuming that there is no example			2	2
explanation of monitoring practice	2	2	2	2
Section E: Calculation of GHG emission reductions	nb days PD	nb days LC	nb days PD	nb days LC
Building scenario for annual values	2	0,5	2	0,5
application of the formula year by year and putting in form:				
Option 1: Project Developer alone	2			
Option 2 : Local consultant alone				1
Section F: Environmental impacts	nb days PD	nb days LC	nb days PD	nb days LC
option 1: EIA clearly required by local legislation and already acknowledged by PD. Then additional exploration of existing documents is require to prepare a short explanation to be translated into English		1		
option 2: PD was not aware that EIA is required by local legislation. Then PDD requires investigation to be able to respond				2
Section G: Stakeholders comments	nb days PD	nb days LC	nb days PD	nb days LC
Preparation of first meeting (communication to public, associations, local politicians) to explain carbon issue	6	1	6	1

and CDM process in local language, and to explain technology choice and consequences (3 persons from PD + 1 LC)				
First meeting (3 persons from PD + 1 LC)	3	1	3	1
Preparation and realization of second meeting for collection of comments (mainly deriving from the consequences of the change of technology)	6	1	6	1
preparing the synthesis of comments and how it has been taken into account	6	0,5	6	0,5

	option 1		option 2	
	nb days PD	nb days LC	nb days PD	nb days LC
Sub-total "PDD prepared in local language"	32,25 days	11,00 days	31,00 days	15,00 days
	1 099 USD	1 540 USD	1 057 USD	2 100 USD

	local translator
	3 days
Translation in English (60 USD/day)	180 USD

		option 1	**option 2**
Sub total 2	**Sub-total "PDD prepared in English"**	**2 819 USD**	**3 337 USD**

		option 1	**option 2**
Sub total 1+2	**Transaction Costs associated to Application**	**3 618 USD**	**4 415 USD**

3. Monitoring

	option 1: reporting each seven years, 21 years crediting period		option 2: reporting each year, 3x7 years crediting period	
	Project Developer Manpower	Local Consultant	Project Developer Manpower	Local Consultant
Data storage and reporting	0,50 month / 7 years		0,25 month/year	
length of crediting period	21 year		7 year	
renewing crediting period				3
number of crediting periods	1		3	

		option 1		option 2	
		Project Developer Manpower	Local Consultant	Project Developer Manpower	Local Consultant
Sub total 3	**Sub total Monitoring during all the crediting period (*)**	1,5 months	0 days/year	5,3 months	9 days/year
		750 USD	**0 USD**	**2 625 USD**	**1 260 USD**
		750 USD		**3 885 USD**	

(*) non discounted values. For the final calculations, which results are presented in the figures below, theses values have been discounted using the same discount rate than for estimating the CERs present value.

4. Contractual arrangement with OE for validation, verification and certification

	option a: small local OE	option b: large international OE
validation and reporting to EB	10 days	7 days
	2 000 USD	**7 000 USD**

	option 1: reporting each seven years, 21 years crediting period		option 2: reporting each year, 3x7 years crediting period	
	option a: small local OE	option b: large international OE	option a: small local OE	option b: large international OE
Verification and certification (man days per time the task is done)	3 days	3 days	3 days	3 days
cost each time verification and certification are done	**600 USD**	**3 000 USD**	**600 USD**	**3 000 USD**
number of time the task is done	3	3	21	21
cost verification and certification (*)	**1 800 USD**	**9 000 USD**	**12 600 USD**	**63 000 USD**

		option 1.a	option 1.b	option 2.a	option 2.b
Sub total 4	**Contractual cost with OE (*)**	**3 800 USD**	**16 000 USD**	**14 600 USD**	**70 000 USD**

(*) non discounted values. For the final calculations, which results are presented in the figures below, theses values have been discounted using the same discount rate than for estimating the CERs present value.

Table n°6: Total monetary Transaction Cost for a Small Scale project associated to CDM Simplified Procedures

		option 1.a	option 1.b	option 2.a	option 2.b
TOTAL 1+2+3+4	**Total Monetary Cost (Sub-totals 1+2+3+4) (USD) (*)**	**8 168 USD**	**20 368 USD**	**22 900 USD**	**78 300 USD**

(*) non discounted values. For the final calculations, which results are presented in the figures below, theses values have been discounted using the same discount rate than for estimating the CERs present value.

Comments:

One should stress the very high share of transaction costs deriving from the OE contract price, mainly due to the specific costs induced by recurrent verification and certification tasks. One way to minimize this weight is to reduce the frequency of such tasks. It is what we proposed in option 1 (verification and certification are performed only each 7 years, renewing of the crediting period has been suppressed). Buy even in option 1.a, contractual costs to be paid to OE still represents 46%. For option 2.b, OE costs represent 90% of the total transaction costs[6].

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6 Before discounting

IV. Sensitivity Analysis of Transaction Costs against Carbon Prices and Discount Rates

First of all we calculated the variations of the value of the CERs earned by the project according to two main parameters, that is the Carbon Price and the Discount Rate used in the calculation of the present value of CERs and transaction costs. The results are presented in the figure n°2 below:

Figure n°2:

Variation of the Present Value of the CERs in function of the carbon price and the discount rate used
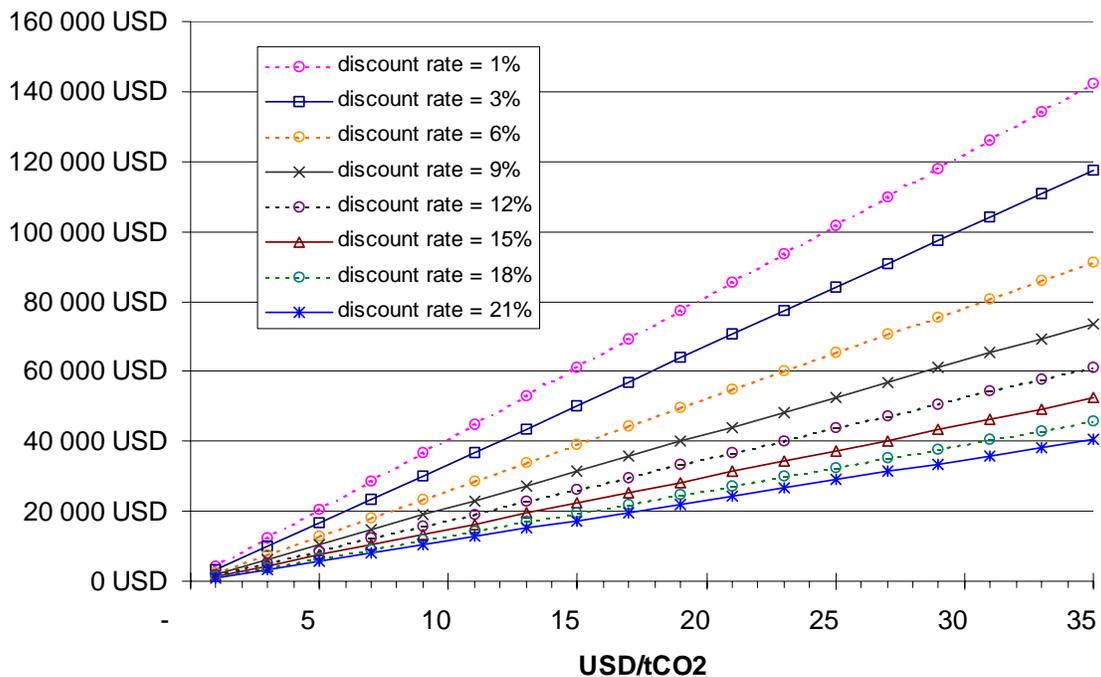
As expected, the present value of CERs is highly sensitive to the price of carbon and to the discount rate used.

Then we calculated the transaction cost for the different options presented above, also in function of the price of the ton CO_2 and of the discount rate.

Finally, we studied the variation of the relative share of the CERs value consumed to cover the transaction cost, also in function of the discount rate and the price at which the CO_2 is supposed to be sold.

The figure n°3 presents the results for the option 1.a, that is the lowest hypothesis regarding the transaction costs calculated above. The figure n°6 presents the results for the highest hypothesis, i.e. the option 2.b.

Figure n°3: (option 1.a) *OE charges "local rates" and simplification of procedures has reduced to the minimum the occurrence of recurrent tasks such as verification/certification and renewal of crediting period, very limited assistance from local consultant.*

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 1.a (lowest costs hypothesis)

Legend:
- 1 USD/tCO2
- 3 USD/tCO2
- 5 USD/tCO2
- 7 USD/tCO2
- 9 USD/tCO2
- 11 USD/tCO2
- 13 USD/tCO2
- 15 USD/tCO2
- 17 USD/tCO2
- 19 USD/tCO2
- 21 USD/tCO2
- 23 USD/tCO2
- 25 USD/tCO2
- 27 USD/tCO2
- 29 USD/tCO2
- 31 USD/tCO2
- 33 USD/tCO2
- 35 USD/tCO2

x-axis: discount rate
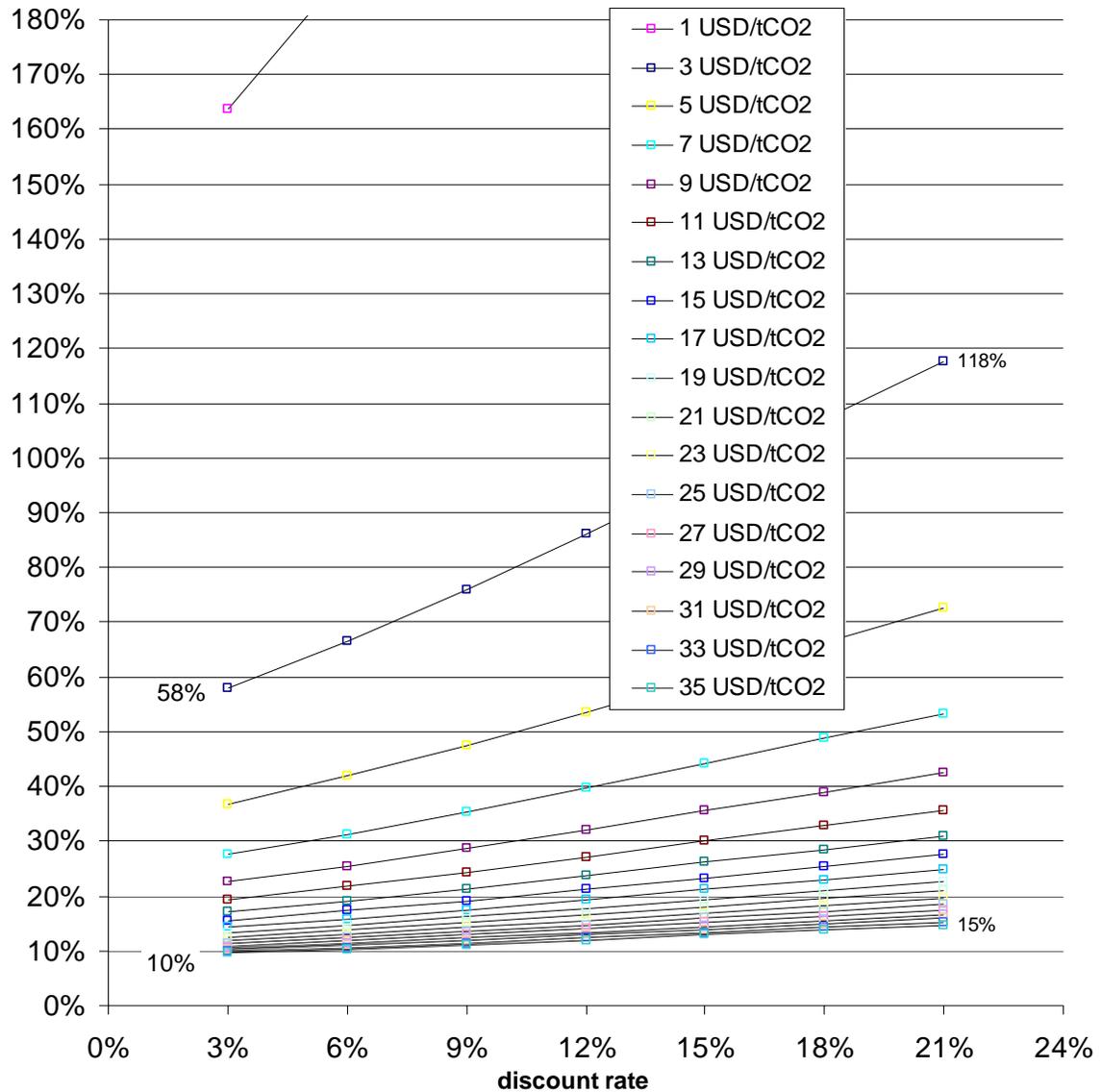
Figure n°4: (option 1.b) *Same than 1.a but OE charges "international rates"*

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 1.b

Legend:
- 1 USD/tCO2
- 3 USD/tCO2
- 5 USD/tCO2
- 7 USD/tCO2
- 9 USD/tCO2
- 11 USD/tCO2
- 13 USD/tCO2
- 15 USD/tCO2
- 17 USD/tCO2
- 19 USD/tCO2
- 21 USD/tCO2
- 23 USD/tCO2
- 25 USD/tCO2
- 27 USD/tCO2
- 29 USD/tCO2
- 31 USD/tCO2
- 33 USD/tCO2
- 35 USD/tCO2

x-axis: discount rate
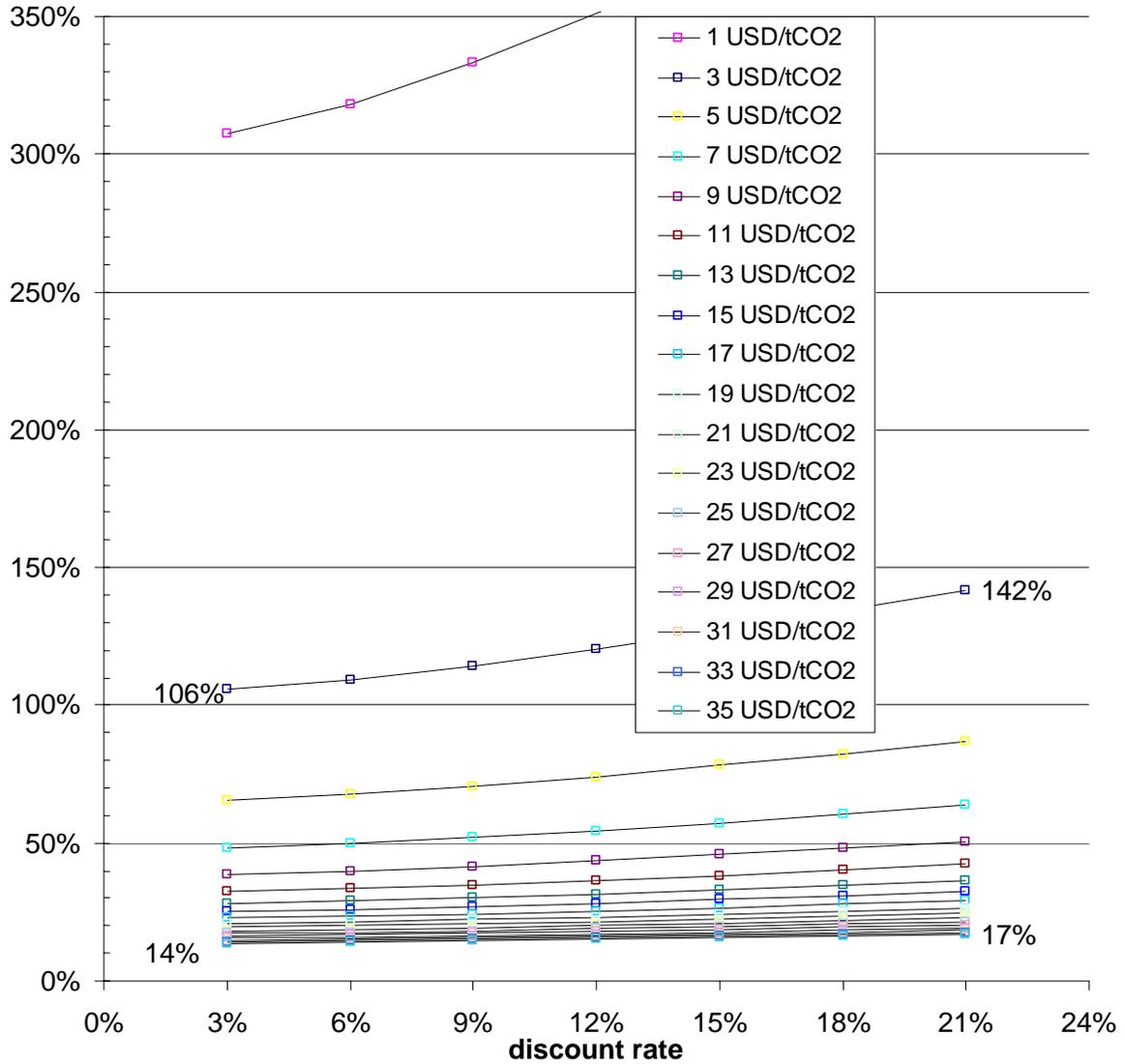
Figure n°5: (option 2.a) *OE charges "local rates", all recurrent tasks are maintained, project developer hires a local consultant to assist him for most of tasks*

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 2.a

Figure n°6: (option 2.b) *Same than 2.a, but OE charges "international rates"*

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
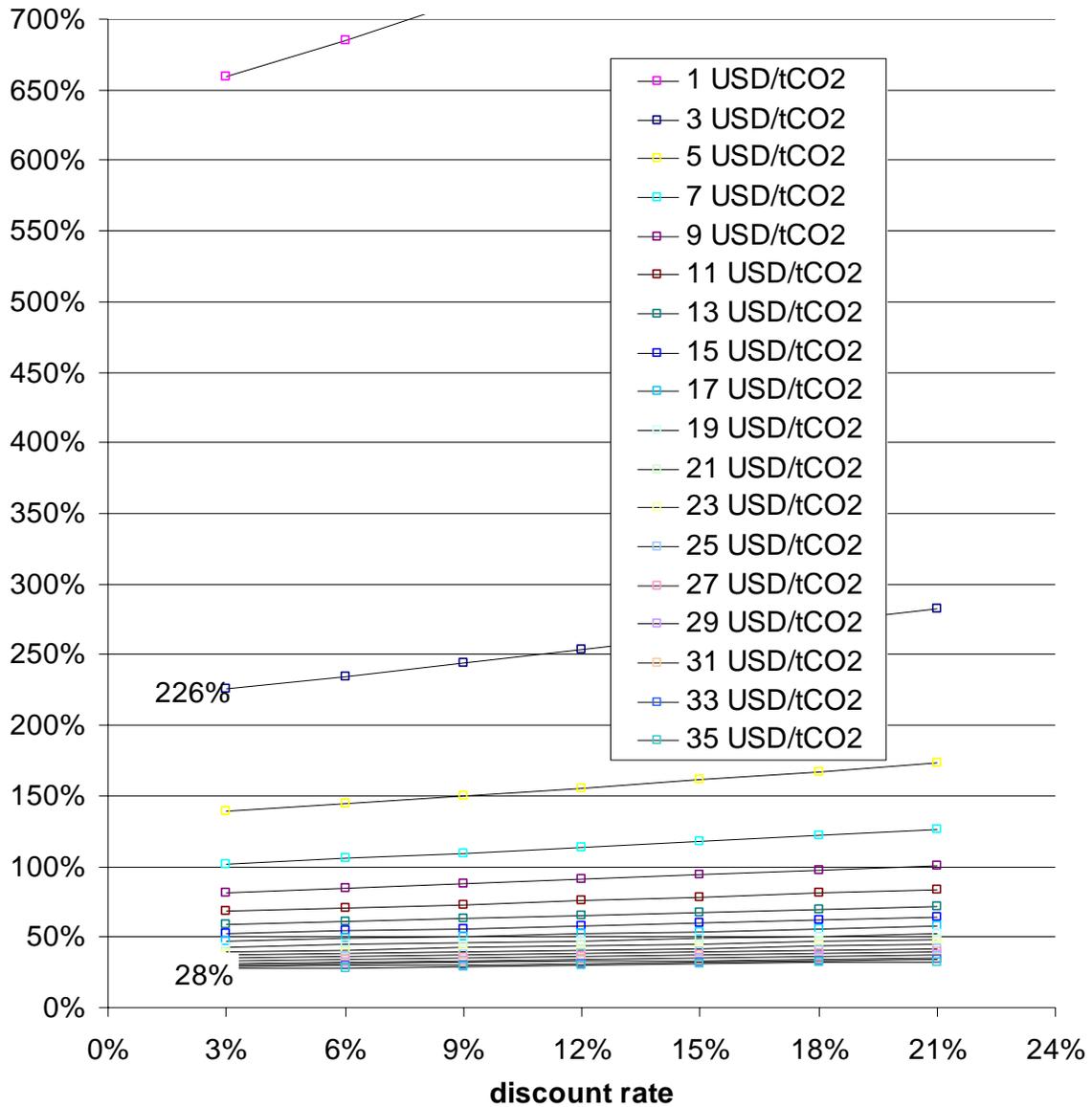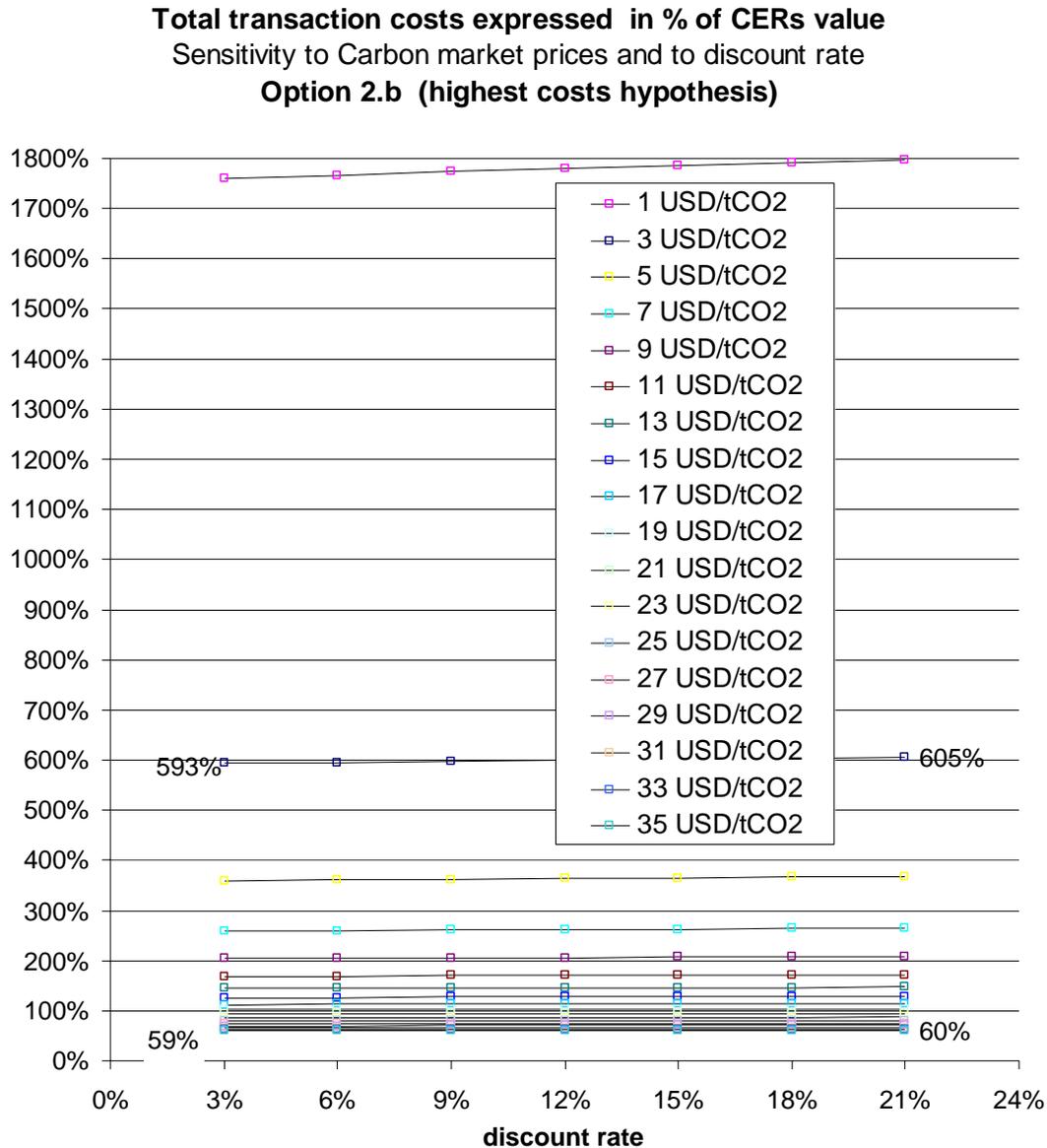**Option 2.b (highest costs hypothesis)**

Observations:

1. It is worth to note that the relative weight of the transaction costs is highly sensitive to the variation of discount rate when the transaction costs are lower (option 1.a), and becomes insensitive when the same are high (option 2.b), that is, the curves becomes totally flat. We will come back on this specific point later, when addressing carbon finance issues.

2. The sensitivity to the price of CO_2 is higher in the case of option 2.b that is when transaction costs are high. For that option, the break-even point is around 19 USD/tCO$_2$, independently of the value for the discount rate. That is, if the price of CO_2 is lower than 19 USD/tCO$_2$, then the transaction costs are higher than the value of CERS. Such break-even point is below 3 USD/tCO$_2$ for option 1.a (assuming a discount rate lower than 18%).

V. Carbon Finance Potential Impact on Small CDM Energy Projects

V.1 Typology of Constraints that carbon finance may help to release:

Any CDM project shall be additional in the sense defined in article 12 of Kyoto Protocol. In economical terms, it means that the CDM project activity is facing constraints or barriers that prevent the realization of it and that the issuance of CERs may help to overcome.

The constraints can be of various natures, and we will try to present generically below the most frequent constraints that investment projects are frequently facing in Developing Countries, and which may prevent their realization or undermine their economical sustainability.

V.1.1 Constraints on Investment Cost Financing:

Among the principal economic constraints opposing to the realization of projects there is the limited access to finance that can be detailed in :

- limited availability of equity
- limited access to loans

The limited access to finance generally is a consequence of :

- too limited rate of return, as a consequence of insufficient revenues or too high transaction costs (i.e. bureaucratic transaction costs, etc.). In the specific case of CDM project, the clean technology may induce higher costs and a lower rate of return than the conventional one.
- too high level of uncertainty regarding expected revenues (commercial risks regarding level of sales and default payment, 'country risk' i.e. devaluation risk, risk of political or social troubles, technology risk when the technology is not yet totally mature, etc.).
- unavailability of finance, especially in highly indebted countries or for projects that are too small for the conventional banking system.
- impossibility to satisfy guarantee conditions claimed by banks.

Such a typology of financial constraints could be improved and completed by experts in project finance, in order to get o more complete view of the type of constraints for the release of which carbon finance could be used.

V.1.2 Constraints on Sustainability after Implementation:

Certain type of projects, typically public infrastructure, incorporates a part of public funds and a part of direct contribution from users (for instance households). It may occur that even if the initial investment cost is fully financed by contributions that don't require remuneration (for instance grant money, users contributions), the sustainability of the project can still be endangered by the lack of resources to cover O&M expenses and /or equipment amortization.

V.1.3 Other Constraints:

Besides economic constraints, other barriers may also prevent the realization of a CDM project (see Gouvello, 2002):

- lack of mastery of the clean technology in the host country,
- high transaction costs opposing to the entry of the foreign investors who master the clean technology,
- etc.

Depending on the project characteristics and project developer's profile, certain constraints may be more difficult to release than others, and may prevent the realization of the project.

Such a typology can be used to explore how carbon finance may help to overcome one or another constraint, and which type of intermediation may be useful to use carbon finance for such purpose.

V.2 Carbon Finance as a Means to use the Carbon Revenue to release Constraints preventing the Realization of Clean Energy Projects

V.2.1 To help to reach a minimum internal rate of return:

The most obvious way to use the carbon revenue derived from the CERs earned by a CDM project, is to use it as an additional revenue that may improve the profitability of the considered project.

It may help to reach a minimum rate of return to guarantee the participation of private investors and/or to get loan approval from banking institutions.

It may help to compensate the incremental cost, which otherwise will create a competitive disadvantage for the clean project against the conventional one.

At least two main considerations should be expressed:

*   Diversification of Risks:

It is worth to note that the CDM revenue present different characteristics than the usual commercial revenue generated by the main activity of the project. While there are still huge uncertainties regarding future price level on the carbon market, CERs are not exposed to risk of inflation and devaluation. Such diversification of risks may help to overcome the reluctance of potential financial partners (borrowers and investors).

*   Concentration of CDM Incentive Effect on the Private Participation

It must be also pointed out that a great number of so-called development projects, which have been carried out in Developing Countries, have indeed mixed official-private financing structures. Such kind of financial set up can be observed in public commercial services, leading frequently to delegated management contracts. It is usually the case in urban transports (buses metros), in garbage collecting, in rural electrification, in certain road infrastructures etc….

When the activity is not profit-making and cannot be spontaneously developed by the play of the market forces, the taking over of a part of the costs on official funds or parapublic funds proves to be necessary to succeed in attracting private capitals.

Direct financing of a part of the investment costs by Public Authorities, without participating to commercial revenues, is consequently justified by the expected benefits from the project for the community. It is the *social revenue* generated by the project.

The financial set up may combine one part of private investment brought by the concessionaire, which is limited by the shortage of expected revenues to remunerate the totality of the investment, and a part of public funds.

In that case, the decision criteria for potential private investors is no more the Internal Rate of Return of the whole project investment, but only the rate of return on the private equity.

As a result the influence of the carbon revenue on the project feasibility can be higher if it is concentrated on the remuneration of the private capital contribution.

Two different effects can be desirable and combined:

- one is two reach a minimum level of profitability for the private equity.
- the second is to make it possible to increase the private contribution.

As an illustration, we present below in Annex 3 the results of business plan simulations for the E7 Tahumanu Project in Bolivia, analyzing the recycling of the carbon revenues to increase private contribution in equity[7]. This study shows that if assuming a theoretical price of 25 USD/tC02, the private contribution in equity can be doubled, from one third to two third of the initial investment cost, maintaining a remuneration of 15%. Such case study, however, doesn't yet integrate any consideration regarding transaction costs, since at the time the corresponding study was done, too much elements were still to be defined regarding the practical administrative CDM process.

V.2.2 To Help to Finance the Initial Investment Cost:

Intermediaries can be established to offer to purchase in advance the CERs that a project being set up is forecast to "produce".

This way the purchaser ensures that they can procure CERs at a known, attractive price, whereas the free market for permits shows great uncertainty. This is precisely the pioneer role played by the Prototype Carbon Fund (PCF) created by the World Bank.

The role of such intermediaries, or brokers can be twice:

- to directly provide up-front "cash" for projects those need such initial funding in order to be implemented. Such up-front purchase works as a loan, where the repayments are the CERs produced by the project along its crediting period. The value paid for such up-front purchase depends on future market prices anticipations and on the discount rate the carbon financer will decide to apply.
- to sign future CERs purchase commitment that helps project developers to get loans from conventional banking institutions.

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7 Based on de Gouvello & alii: " The Clean Development Mechanism in the Electricity Sector: Sharing the Carbon Rent between Development and Investor Return. The Case of the Tahumanu Hydroelectric Project in Bolivia", communication in French to the World Energy Congress (Discussion Session 17), Buenos Aires, October, 21-26, 2001, 12 p. An English paper will be published in March 2003 in "Greener Management International" (Special Issue, edited by Katie Begg).

As an illustration, we present in figure n°7 the proportion of initial investment cost the carbon revenue can represent in the case of the Chel Project. Two set of curves are superposed in the graph, each one corresponding to a different vertical axis: the axis on the left measures the carbon revenue as a % of total investment cost (power plant+grid+access road), and the axis on the right expresses it as % of only the power plant investment cost.

Figure n°7: The Carbon revenue expressed as % of initial investment cost: *The case of the Chel Project*

Carbon Revenue expressed in% of initial investment cost - Chel Project
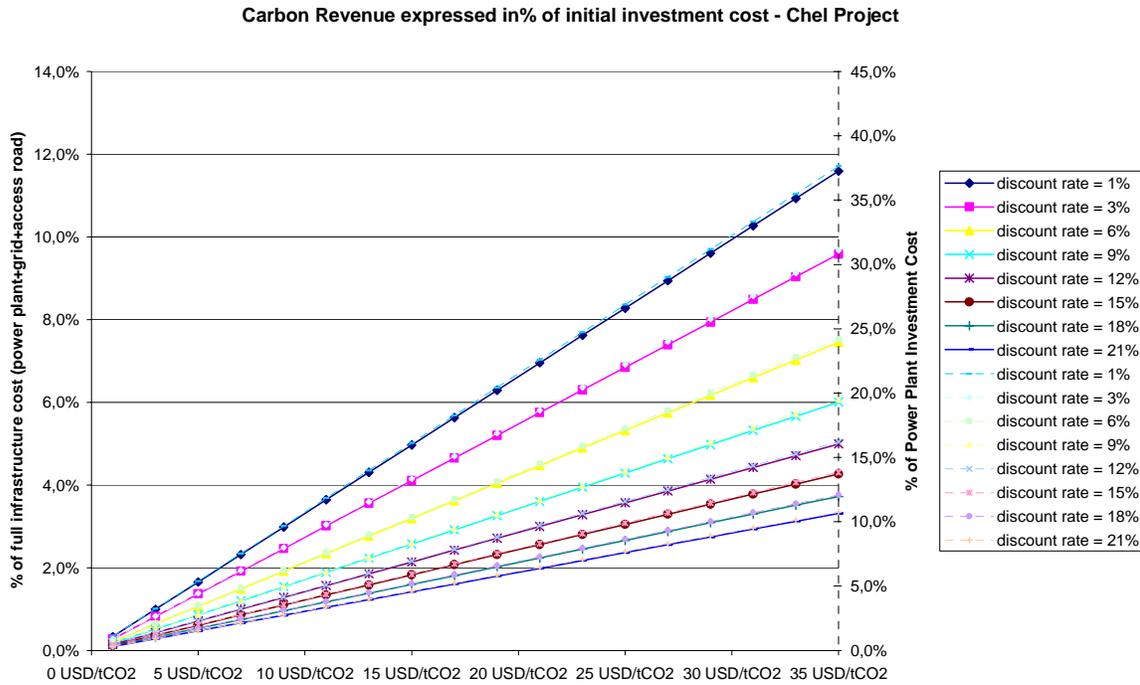
As second illustration, we present in Annex 2 a synthesis of a study that has assessed the relative share of initial project cost the carbon revenue can represent in the case of a large Decentralized Rural Electrification project (15 000 households), totaling less than 1 MW of installed capacity. In that study, the hypothesis regarding carbon revenue valuation considered a price of 50 USD/tC that is 13,6 USD/tCO$_2$, and a discount rate equal to 14%. Like the previous one, this case study doesn't yet integrate any consideration regarding transaction costs, since at the time the calculations were done, too much elements were still to be defined regarding the practical administrative CDM process, including regarding Small Scale Projects. In such a project, according to the certification time schedule, the present value of the carbon revenue can represent almost 10% of the initial investment cost of the project.

V.2.3 To Support the Long Term Sustainability of the Projects:

Generally rural energy projects cannot get subsidies for operation and maintenance costs. However, for certain projects it may be very difficult to secure regular payments from users to cover such costs. It can be the case for instance of energy systems providing energy to rural health centers or rural schools, for which it may be difficult to collect payment either from local authorities or from the families benefiting from such social services.

In that case carbon finance may help to cover O&M costs on the basis of the emission reductions that such small energy systems may be able to achieve.

V.2.4 Carbon Finance as a Tool to Address other Constraints:

Carbon finance may also be a tool to attract new agents who are not facing same constraints and barriers than current project developers, and thus, indirectly, contribute to overcome constraints other than lack of profitability.

This is typically the case for innovative clean technologies and know-how, which may not be mastered by local project developers. Channeling the carbon revenue to Annex 1 companies who master clean technologies may be a function of carbon finance to incentive technology transfer, and/or to attract such new partners in CDM projects.

V.3 Carbon Finance as an Indirect Means to Reduce the Relative Burden of Transaction Costs

We have seen above that the relative weight of transaction costs for small CDM energy projects compared to the carbon revenue was not only sensitive to the level of carbon prices but also to the discount rate used.

In fact the discount rate can be interpreted as a representation of the financial conditions offered by the carbon financer to the project developer. This is especially clear when the carbon financer accepts to finance an up-front purchase of the CERs that will be generated during the crediting period : in that case the discount rate represents the interest rate applied to calculate the up-front payment corresponding to the present value of the future CERs.

If the CDM transaction costs are also financed by the carbon finance, then the same discount rate can be used in the calculation of the present value of both the transaction costs and the carbon revenue.

Then, the sensitivity analysis of the relative weight of transaction costs compared to carbon revenue against the discount rate can be seen as an economic tool to explore the impact of the carbon finance on it.

It is interesting to note that only option 1.a, 1.b and 2.a, corresponding to low transaction costs hypothesis, show a significant sensitivity to the discount rate. This can be seen in figures n°8 to 10.

The reason why option 2.b (figure n°11) is not sensitive is mainly because in that configuration recurrent costs (monitoring, verification and certification) assume a very high share of the total monetary transaction cost (more than 80%). Thus the impact of discounting is similar on transaction costs and on the value of CERs.

But for options 1.a, 1.b and 2.a, it is also clear that lower the carbon price, greater is the sensitivity to the discount rate.

For instance, for option 1.a, if assuming a price of 3 USD/tCO2, the transaction cost lowers from 86% of the total CERs value for a discount rate of 12%, to 58% for a discount rate of 3%.

And for a price of 9 USD/tCO2, the same variation of discount rate leads to a drop from 32% to 23%.

Such observation seems to have interesting consequences regarding the impact of carbon finance on transaction costs for small-scale projects.

As result it appears that, when carbon prices are low, the conditions of financing the purchase of CERs are of greater importance on the relative weight that transaction costs will represent. If recurrent costs (monitoring, verification and certification) are reduced to the minimum, offering carbon finance under very favorable conditions for both the purchase of CERs and the financing of transaction costs, seems to be an efficient way to reduce the relative burden of transactions costs for small-scale projects when carbon price are low.

Figure n° 8

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 1.a

When carbon prices are low, the relative weight of transaction costs is highly sensitive to discount rate

- discount rate = 1%
- discount rate = 3%
- discount rate = 6%
- discount rate = 9%
- discount rate = 12%
- discount rate = 15%
- discount rate = 18%
- discount rate = 21%

USD/tC02

Figure n°9

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 1.b

Figure n° 10:

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 2.a

Figure n°11:

Total transaction costs expressed in % of CERs value
Sensitivity to Carbon market prices and to discount rate
Option 2.b

Annexes

Annex 1:
Carbon Rent and Basic Economics of CDM Projects Decision Framework

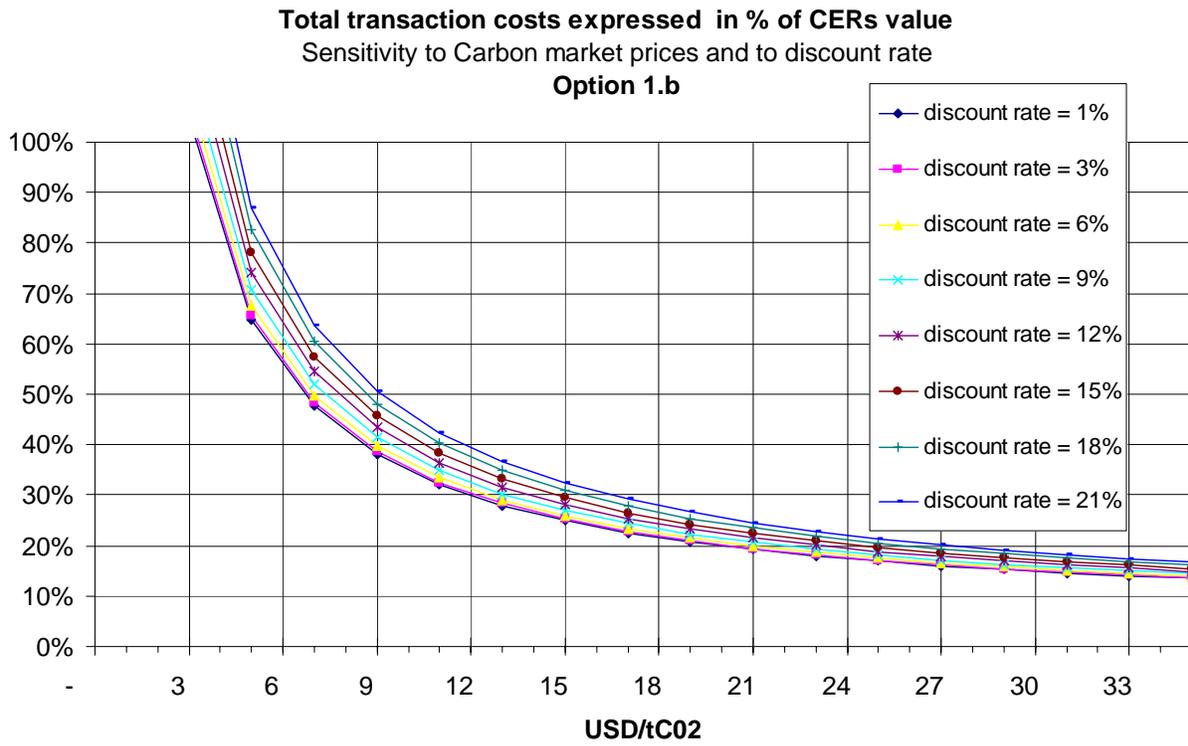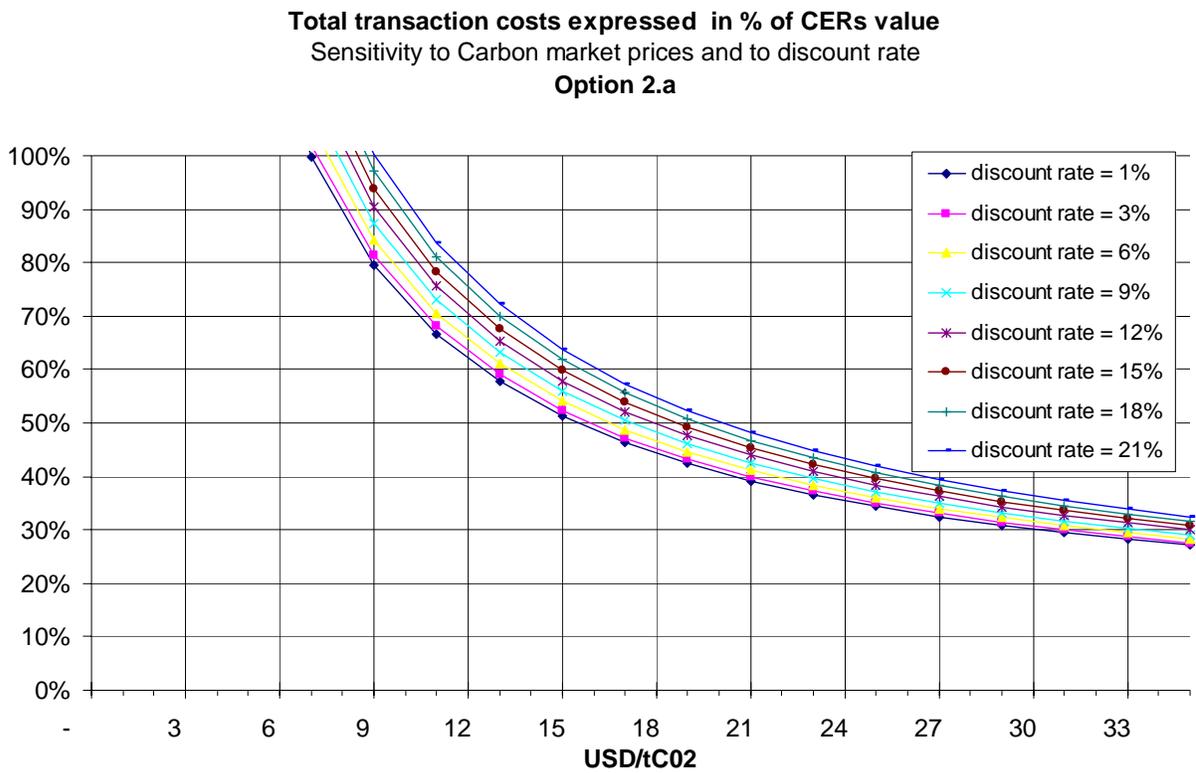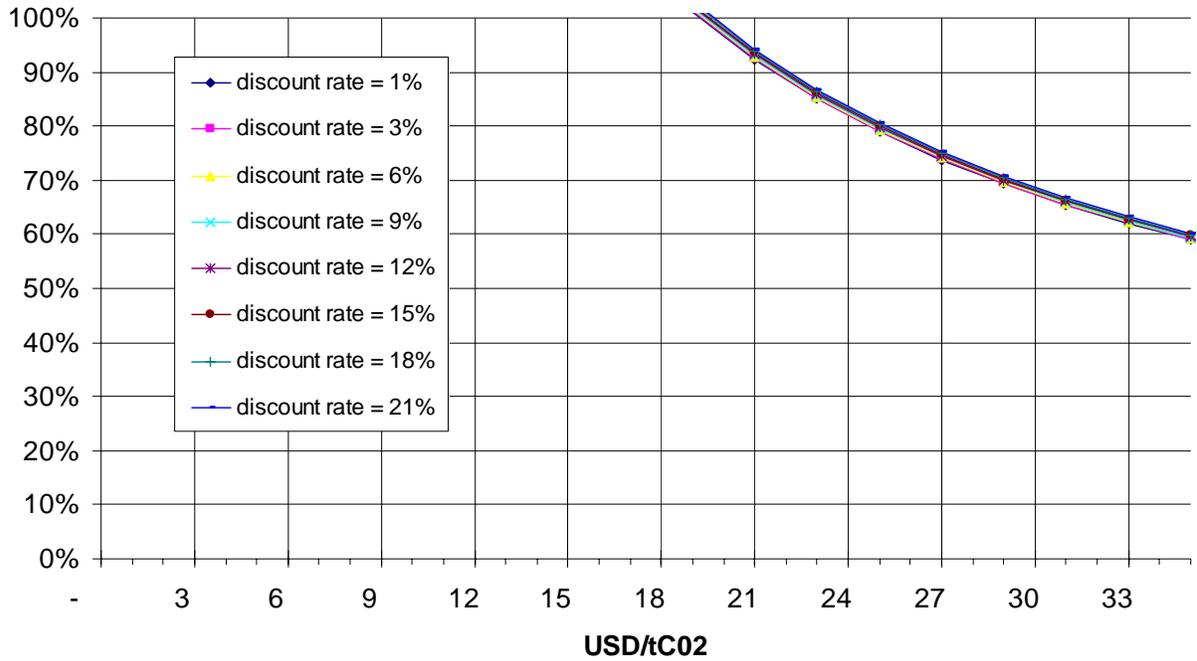One way to present the basic economics of CDM projects is to bring out the triple nature of expected rents, which are:

- the classical **Commercial Rent** for a private investment from which it is necessary to deduct classical transactions costs associated to foreign direct investments, and depending among others on the host country characteristics.

- the **Environmental Rent**, which derives from the volume of emission reduction certificates (CERs), and from their enhanced value modes, and from which one has also to deduct specific transaction costs related to the procedures of CDM. It can produce new revenues from the sale of CERs.

- the **Social or « Developmental » Rent** which corresponds to the increase in the offer of products and services necessary to the economic and social development of the country, or else to the production of positive externalities – versus reduction of negative externalities - in the host country.

Finally it is from the combination of these three rents, whose relative proportions change from one project to another – and not only from the environmental rent, that the common decision to achieve a CDM project will arise. This decision will not only depend on the global value of these rents but also, if not even more, on the negotiated sharing of it, case by case, between the different protagonists of the project.

To be clear, the host country will take in account mainly the social rent and the share of the carbon rent that he will gain, when the private project developer will consider mainly the commercial rent and his own share of the carbon rent.

Different Type of Motivations for a Private Investor in a CDM Project:

It is important not to have a too narrow vision, which would consist in considering that the exclusive motivation of a « CDM » investor would be limited to the generation of low cost emissions reductions. Of course this motivation is quite natural. It is present for instance in a project of modernization of a cement factory leading to reducing the greenhouse gases emissions which had been noticed before, and this at a unit cost that proved to be below the margin abatement cost present in the country of the investor, or on the TEP[8] market. Such an investor acts according to a cost-efficiency logic. He decides to invest if his analysis shows him that the unit cost of the reductions will be lower than the costs he would have to face in his own country to stick to the quantitative goals of reduction he is responsible for. Or else, he will try to generate reductions whose unit cost is below the usual prices on the TEP market in order to get the difference.

But the range of eligible projects at CDM is in fact much wider because it is indeed an economic signal sent to the totality of foreign investment opportunities in every sector, whenever there is a technical alternative enabling to avoid greenhouse gases emissions.

Of course we can imagine economic agents, which would only invest in the "additional project" or "dual" project as far as this latter, can ever be identified. Such a project would consist in isolating the difference of cost between both projects (the "clean project" and the baseline project) and in bringing it back to the quantity of certified emission reductions. Of

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8 Tradable Emission Permits

course such "dual" investors would then only be interested in projects whose thus calculated emission reduction unit cost would be below the market price of emission permits. But as to the other projects whose reduction unit cost would be superior or incalculable, the main investor might not find any additional investor, but nothing will prevent him from valuing the CERs he could claim by offering them on sale at the market price. It will always be a welcome additional rent.

It is advisable therefore to change a bit the perspective of the analysis. For most industrial investment projects, the decision is mainly guided by analysis of the type *cost-benefits* : an investment project is but only achieved if the *cost-benefits* analysis is conclusive for the investor whose main revenues will first come from the marketing of products and services resulting from the main aimed at activity, i.e. from the *commercial rent*. The value of emissions reductions certificates expected on the emissions permits market is in this case added to the conventional commercial income, and can therefore possibly make the difference when comparing the business plan of the « clean » project and of the one of a « dirty » project, taken as a reference project. The certificates emitted in the framework of CDM consequently appear as an additional *environmental rent* in the analysis of the variants of investment projects. It is important to stress that such additional rent is not necessarily associated to additional costs ("incremental cost"), either calculable or not.

Of course such internalization of the carbon rent becomes easier if there exist intermediaries offering to purchase in advance the CERs at a fix price.

Another way to express the difference of behavior between both investor types is to consider that the first one acts on the carbon market as a price-maker: he will look for CDM GHG emission reductions potentials which production costs are lower than the market price and, if the market is competitive, he will be able to propose a price lower than his competitors. The second act more as a price-taker: he will compute the environmental rent calculated on the basis of the price signal sent by the market

Sharing Agreement between the Host Country and Private Investors

Regarding the sharing of the Carbon Rent, the Decision 15/CP.7[9] specifies in paragraph 6 of Appendix D that CERs issued should be distributed among projects participants according to the specifications they have registered in their distribution agreement.

When considering private project developers perspective, it is clear that the impact of the carbon rent on the economics of the project will depend directly on the share allowed to the project and on the share allowed to the host country.

It means that DCs governments will have to make choices between maximizing the direct carbon income by capturing an high share of CERs, or maximizing the capacity to attract additional foreign investments, by handing over an higher share of the carbon rent to private project developers.

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9 Decision 15/CP.7 :Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol:

Paragraph 6 of Appendix D:

Upon being instructed by the executive board to issue CERs for a CDM project activity, the registry administrator shall, in accordance with the transaction procedures set out in the modalities for the accounting of assigned amounts under Article 7, paragraph 4:

(a) Issue the specified quantity of CERs into a pending account of the executive board;

(b) Forward the quantity of CERs corresponding to the share of proceeds to cover administrative expenses and to assist in meeting costs of adaptation in accordance with Article 12, paragraph 8, to the appropriate accounts in the CDM registry for holding and transferring such CERs;

(c) Forward the remaining CERs to the registry accounts of project participants and Parties involved, as specified by their distribution agreement.

Annex 2

Case Study # 1:

Impact of the Carbon Revenue on a Decentralized Rural Electrification (DRE) Project:
Analysis of Sensitivity to the Baseline Choice[10]

For some years, several developing countries have been experimenting with a new type of rural electrification, decentralised rural electrification based on renewable energies (RE). This consists in installing individual systems (photovoltaic or wind energy) in rural households or in setting up electricity distribution mini-grids fed by small RE or mixed (RE-diesel) plants.

Rural electrification based on renewable energies enables provision of various individual end-use energy services, including mainly lighting, television and radio (8), and community services such as water pumping and services for productive purposes (workshops, farming activities).

As they involve renewable energies without greenhouse gas emissions (9), several projects of this type are co-funded by the GEF.

V.4 Substitution of Present Consumption of Petroleum Derivatives – the GEF Baseline

It is important to note that, although not connected to the electricity grid, rural populations are nevertheless not completely deprived of lighting nor of access to electricity services. There are always forms of lighting, ancient or modern, in use by rural populations, often for several generations, independently of any prospect of connection to the electricity grid. Such facilities are most often kerosene lamps for lighting and various forms of conventional drawing systems for water supply. Similarly, households without a battery-operated radio are rare. Higher-revenue households also increasingly have television sets powered by direct current from batteries, which are recharged in the town or on a vehicle. Craftsmen sometimes have generator sets to power their electrical tools. These "conventional" energy service consumptions, preceding any electrification programme, are studied and give rise to distribution surveys as part of the preparatory studies for decentralised rural electrification projects funded by the GEF or other international donors.

It is thus common knowledge that there is a demand for these services, and that there are forms of supply that the rural populations, left to themselves, look for and find on the local market.

As the technical solutions generally consume fossil fuels directly or indirectly (batteries), the future rural demand for such services, just like the past rural demand, generates CO2 emissions. The substitution of these techniques by renewable energy systems therefore eliminates the emissions associated with them. Although the avoided emissions are small on an individual level, the very large number of households, craftsmen and rural community services to which this solution could be extended means that its medium-term environmental impact is non-negligible. However, although the technique is well mastered in itself and proven in limited schemes (a few dozen users), the large-scale diffusion of this technical solution poses new problems of implementation at acceptable cost. Such projects require

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10 See de Gouvello, Ch. & Maigne, Y.:" Decentralized Rural Electrification : Techniques for the Planet, a chance for Men", op. cit. (Nov. 2002)

methodological innovations (analysis of the needs and the payment capacities of the potential users), organisational innovations (costs of managing a large number of dispersed equipment units and financial micro-flows, linkage between informal economy and formal economy), institutional innovations (coexistence with the electricity grid extension technology within an adapted or separate regulatory framework, combination of several local public services governed by different regulations) and innovations in terms of funding packages mixing private-sector contributions and public-sector contributions as part of sectoral public development policies

The GEF thus finds here arguments demonstrating that such projects reduce future emissions in the medium term, and includes in the additional costs the costs of learning and of accompanying measures, enabling the costs of large-scale diffusion to be lowered in the long run.

This reasoning enables the analysts of projects considered by the GEF to adopt as a baseline the techniques existing before any electrification and village water supply programme. The additional costs and the avoided emissions are calculated with respect to this baseline (Meyer & alii, 1999).

V.5   Development and Avoidance of New Emissions – the Baseline of the CDM

These solutions, often referred to as "conventional", are not judged satisfactory, either by the households (poor quality, high demand on the users' cash flow or the work force, limited character of the service) or by the governments, which almost always place rural electrification and village water supplies among the leading development priorities. The aim is to reduce negative externalities (health problems related to incomplete combustion smoke and to consumption of contaminated surface water), to produce individual and community benefits (enabling teaching and night-time health care, broadening access to communication facilities, improving the productivity of certain activities, facilitating social life, etc.) and to work towards equity targets (broadening the access of the most disadvantaged populations to basic services and eliminating the extra cost incurred by unavoidable use of stop-gap solutions).

Independently of any consideration related to climate change, the governments of the developing countries are therefore implementing rural electrification programmes.

However, over the last few decades, one technology has predominated both in the developing countries and in the industrialised countries: the electricity distribution grid, fed by centralised electricity generating plants (10). This is the only technology mastered in the developing countries, and has given rise to specific institutional structures. All countries, industrialised and developing, have proceeded or are proceeding by successive programmes extending the grids from the urban centres to increasingly remote or dispersed rural areas. Many countries have completed their rural electrification (the case of the industrialised countries); some countries in transition, and some of the more developed provinces of developing countries, are completing the coverage of their rural territories. Finally, for others, this prospect seems out of reach in the medium term, although initiatives are taken to this end. It must again be emphasised that these programmes always show substantial deficits in terms of costs-receipts balance sheets. Rural electrification is thus burdened with both the restricted access to funding and its structural deficit.

As long as large-scale decentralised rural electrification techniques are not mastered by these countries, it is clear that, in the absence of any transfer of technology and know-how, they will have no alternative to the gradual extension of their grids.

Once the development perspective introduced by the CDM is accepted, the baseline adopted by the CDM might be thus the grid technique. In overall environmental terms, the baseline is therefore the greenhouse gas emissions by centralised electricity generation.

V.6 Calculation of Avoided Emissions and the Climate Income: a Significant Incentive

It is relatively easy to estimate the emissions avoided according to each of the "GEF" and "CDM" baselines as defined above. These calculations depend on kerosene consumptions before electrification and on the quantity of kWh consumed by rural households after conventional electrification by the grid in the region considered. As a simplification, only the consumptions of the lowest-income social groups were considered, essentially for lighting needs, knowing that the highest-income rural households have higher consumptions. This ensures that only consumptions that can be effectively substituted by REs through DRE are considered[11]. This is clear as far as the "GEF baseline" (kerosene) is concerned, but is also realistic for the "CDM baseline" (interconnected grid): it is true that the demand for energy services of even the lowest-income households increases and diversifies when they access electricity—typically, television spreads more rapidly—but surveys in electrified rural areas show that low-income rural households barely have the means to acquire and run high-consumption appliances, such as refrigerators, which cannot be powered by small individual systems[12]. In any case, the increase in the consumption of energy services after electrification, whether through the grid or decentralised, is not a problem in the context of the CDM; quite the contrary, since it is an indicator of a contribution to development, which is precisely the purpose of the clean development mechanism.

The calculations given here use consumption data obtained from field studies carried out in Ceará state, in Brazil, in 1997[13], but similar orders of magnitude can be found in Africa and Asia. Consumption values of 5 litres of kerosene per month before electrification and 17 kWh/month after connection to the grid were used.

In order to assess the economic incentive resulting from the pricing of CO2 emission reductions in photovoltaic DRE projects, the case considered was a project of this type aiming to equip 15,000 rural households, with an average initial investment per household of US$1,000, giving a total investment cost of about 15 million dollars. A 20-year lifetime was assumed for the installed photovoltaic systems[14].

The results of the avoided emissions calculations are given in tables 6.a and 6.b.

Of course, the "CDM baseline", i.e. grid connection, depends on the primary energy source used to generate the electricity. In India and China, where more than half the non-connected rural population is probably found, electricity-generating plants are mainly coal burning. This form of generation leads to the inclusion of a much higher volume of avoided emissions than

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11 It is known that substitution of kerosene by lighting powered by individual photovoltaic systems is not total, at least initially (refer to the case study of the first DRE project in Bangladesh), but for the sake of simplification this phenomenon, which does not change the orders of magnitude involved in this exercise, has been ignored.

12 The non-connected rural households that have the means to do so acquire gas or kerosene refrigerators. The situation remains the same after an individual photovoltaic system has been made available.

13 de Gouvello, C.; Poppe, P; Mathieu, P.; Missaoui, R.: "Study of the Photovoltaic Market for Rural Electrification in North-eastern Brazil. States of Bahia, Ceará and Minas Gerais". Report for the World Bank, 140 p., July 1997

14 20 years, which is in fact fairly pessimistic, given that a certain number of manufacturers of solar modules are already offering 25-year guarantees.

the volume estimated from the "GEF baseline"[15]. The quantities of avoided CO2 emissions obviously remain low with regard to the committed investment, leading to a cost of US$524 per ton of carbon for the CDM baseline and US$1,368 per ton of carbon for the GEF baseline.

Without being astronomical if compared to marginal abatement costs observed in Annex 1 countries, the value of the carbon ton obtained when applying the "CDM baseline" is already ten times higher than the predicted market prices, expected to be about US$50 per ton of carbon. Above all, it must of course be emphasised that the emissions reductions obtained are spread over some twenty years, which means that the investment cost should strictly be discounted to the dates on which these reductions are made, thus giving much higher abatement costs. With a discount rate of 8%, for example, abatement costs would be multiplied almost five-fold if the reductions did not give rise to negotiable certificates until the twenty years had elapsed. However, if a mixed investment is involved, only part of which is contributed by a foreign private-sector investor, as the delegated management model specifies, and all the credits are allocated to the foreign private-sector investor, these discounted costs could be divided by two or three.

Even then, DRE based on renewable energies is obviously not a mine of cheap credits justifying specific investments to operate it as such, in the spirit of joint implementation (JI).

However, it is more interesting to calculate the income that could be obtained by the project leader(s), which could sell the corresponding emission reduction certificates on the market. This has been done on the basis of a market price of US$50 per carbon ton, and is shown in tables 7.c and 7.d. Assuming a discount rate of 14%, reasonable for a private-sector investment in the public services sector, the "climate income" is very strongly dependent on the time scale of the issuing of the negotiable certified emission reduction units.

We have therefore simulated three schemes. The first is optimistic, and corresponds to the ex ante issue at the beginning of the project of negotiable certificates equivalent to 100% of the expected emissions reductions (this could be the case of a mechanism involving prefinancing of the reductions by an intermediary such as the Prototype Carbon Fund). The second is excessively pessimistic, assuming certification only at the end of the planned project period. The third, more realistic, also assumes ex post certification, but year by year for the amount of emission avoided during the elapsed year.

Here again, the result is very different depending on whether the "GEF baseline" or the "CDM baseline" is considered.

But what is worth noting above all is that the climate income is highly significant with respect to the initial investment, sufficient in any case to contribute to the project funding package and play a genuine incentive role, particularly if CDM credit advance purchase funds are set up. For the most optimistic scenario, it amounts to 1,43 million dollars, 9.5% of the initial investment; For the median scenario, it still amounts to 500,000 dollars, 3,2% of the initial investment.

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15 We have in fact assumed an emission level of 900 g of CO2 per kWh, corresponding to a high-performance pulverised coal plant, which is optimistic with regard to the present population of power plants.

Table n°7 : Evaluation of emissions reductions and carbon revenue for a decentralized rural electrification project (15,000 households)

table n°7.a: "GEF baseline" – Carbon emissions associated with kerosene consumption before electrification

kerosene hurricane lamp	Monthly consumption of kerosene per household	tep/m3 kerosene	tC/tep	kgC/liter	kgC per month per household	tC per household over 20 years	nbr households	total tC 20 years
	5 litres	0.7	0.87	0.609	3.045	0.731	15,000	10,962

table n°7.b : "CDM baseline" - Emissions associated with electricity consumption after conventional electrification, pulverized coal-burning power station

coal-burning power station	Monthly kWh consumption per household	Line loss rate	gC/kWh on generation	kgC per month per household	tC per household over 20.years	nbr households	total tC 20 years
	17	30%	327	7.9	1.91	15,000	28 613

table n°7.c: Economic assumptions

investment cost per user	total project investment cost		project duration		discount rate		price per tC
1,000 USD	USD 15,000,000		20 years		**14%**		**USD 50.00 /tC**

table n°7.d: Assessment of carbon revenue (present value)

			max (100% ex ante certification)	annual ex post certification	min (100% ex post certification 20 years)
"GEF baseline"	kerosene hurricane lamp	total present value of carbon revenue	USD 548,100	USD 181,507	USD 39,881
		% of investment cost	3.7%	1.2%	0.3%
"CDM baseline"	coal-burning power station	total present value of carbon revenue	USD 1,430,649	USD 473,769	USD 104,097
		% of investment cost	9.5%	3.2%	0.7%

VI. Annex 3

Case Study # 2:

The Example of the Hydroelectric Tahuamanu Project of the E7 Fund in Bolivia:
Impact of the sharing agreement on private financing contribution[16]

The small towns of Cojiba, Porvenir and Villa Bush in the Pando Department in the North of Bolivia, near the Brazilian border, suffer from insufficient power supply that is furthermore temporary and of bad quality. Many users are nowadays supplied by isolated mini-grids energized by small diesel generators, some of which are very old.

About two third of the fuel cost used by those diesel groups is supported today by the central State via a system of specific subsidized prices.

Studies about the evolution of residential and industrial local demand forecast an increase of the rationing of the service in the next years.

To make up for this situation of scarcity, the installation of a new, more powerful and more efficient diesel group (2 x 640 KVA - 400V) is on study on the main site (Cojiba). A MV line linking Cojiba to Porvenir and Villa Busch is also being built. However, the forecasts regarding the evolution of the demand made from the observation of the growth rates which have been witnessed for 10 years, and the growth of industrial activities nearby[17] show a new rationing situation only four years after the installation of the new generators.

The alternative studied by the E7 Fund[18] and submitted to potential private partners consists in building an erasable dam (inflatable tube) tooled up with three Kaplan turbines of 1,980 KW each, coupled up with three alternators (3 x 2,200 KVA - 600V). An integrated company would be created (generation, transmission, distribution) to operate the system. The E7 Fund would be the owner of 51% of the shares[19]. The other shareholders would involve a Bolivian[20] operator and possibly other financial partners if the operator didn't wish to hold all remaining shares.

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16 de Gouvello, Ch.; Hourcade, J. Ch.; Mollon (EDF-E7), P., Saulo A. (ENEL) " Le Mécanisme de Développement Propre dans le secteur électrique: Partage de la rente carbone entre développement et rémunération de l'investisseur. ", communication to the World Energy Congress (Discussion Session 17), Buenos Aires, October, 21-26, 2001, published in French in Revue de l'Energie, n°533, pp 22-29, 2002, January. English version to be also published in Green Management International in March 2003.

17 Particularly the industrial preparation of Brazil nuts and sawmills. The custom-free areas of Cojiba (Bolivian side) and Brazileia (Brazilian side which could be interconnected) are also a factor of economic development of the region. Projects of infrastructure development to open up the area are in progress, especially the building of a 75 km motorway to Peru.

18 E7 is an entity created by 7 large electricity companies of G7 countries to promote a long-term development in the context of the electricity sector, particularly in Developing Countries and in Economies in Transition (EITs).

The E7 has created, among others, the E7 Fund for sustainable energy development, which generates projects aimed at the learning of mechanisms settled in the context of the Rio Convention and of the Kyoto Protocol. The E7 FUND enjoys a special NGO status by the ECOSOC of the United Nations.

19 The capital of the company to be created would be about 8 million US dollars, which is about one third of the necessary investment.

20 The potential operators are Electrogaz, whose main shareholder is Iberdrola, Cobee, the shareholders of which are American or Swedish and CRE a large Bolivian electricity cooperative

The Environment Impact Assessment (EIA) has been made in partnership with the local university and a local environmental NGO, and has shown very limited impacts on the local environment. This technical alternative could make it possible to remove on a long-term basis the constraint that limits the electricity supply which is weighing on the whole of the little towns and local industries. It would equally enable them to end with a fuel oil consumption, which is heavily subsidized and emits greenhouse gases. As such the project may be eligible to the Clean Development Mechanism.

The common decision of the E7 companies and the Bolivian authorities to work out this project under the CDM is the result of the production and the division of the triple rent that it will generate, i.e. :

i) **The social or « developmental » rent** associated to the project and which is formed by several components:

  - the increase of (i) the benefits associated to the use of electricity due to improvement of the access to the service (lengthening of the functioning for a period of 24 upon 24h, possibility to integrate homes located in the periphery of small towns), (ii) the quantity of consumed electricity and (iii) the quality of the service (end of rationing and cuts due to failings). The benefits associated with the use of electricity are characterized among others by the access to a good quality lighting , to the use of basic domestic appliances(refrigerator, iron etc.) and audio visual equipment, as by the improvement of collective services (health, education) and by the development of productive use of electricity, which contributes in fine to economic and social local development

  - the reduction of the cost supported by the national collectivity, as a result of the subsidization of two thirds of the special fuel tariff for isolated systems.

ii) **The Commercial rent** generated by the sales of electricity : which would be able to provide an internal rate of return around 10,7% and would be shared between E7 private partners and the Bolivian State, for instance in the following manner:

  - In the first place, the payment on the revenues of the electricity sales at the statutory tariff, for the capital brought by the investing organism; i.e.:

    * 1/3 in the form of a contribution to the capital by E7 which is not looking for a traditional private investor profitability, but wants to recover on term its investment[21]

    * 1/3 of financing in the form of a 15 years bank loan at 6% with a grace period of 5 years[22].

    * in the form of capital contribution by a private investor, remunerated at a rate of 18 % per year.

  - In the second place, new fiscal revenues, resulting from the taxing of benefits generated by the new activity.

iii) **The environmental rent**, which results from, the avoided CO_2 emissions compared to the reference scenario with diesel generators. Studies so far achieved lead to the conclusion that an annual production of 38GWh will be obtained, which will make it possible to avoid the emission of 30,400 tons of CO_2 a year.

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12 For the needs of calculations presented further we have expressed this contribution in the form of following exploratory hypothesises; 1/3 loan by E7 at 0 % repayable in 25 years.

22 This type of preferential financing conditions can be found at a development bank.

In the case of the Tahuamanu project, the allocation of the environmental rent has not yet been decided by the partners among other things because the effective modalities of CDM have not been completely defined so far[23], but also because the value of this rent can only for the moment be subject to speculation on future market prices of carbon, except to internalise it to the project on the basis of a repurchase agreement between shareholders.

The state of advancement of the Tahumanu project can already make it possible to make two particularly relevant pre-simulations to anticipate the future impact of CDM on the set up, of the clean energy generation project.

First of all let us repeat that the reference scenario – the building of the initially planned diesel group – would lead to a production cost of USD174,00/MWh[24] brought back to USD 81,60/MWh by the subsidies granted by the Bolivian Government to fuels for electricity generation in isolated systems[25].

Depending on the share of the production that will be sold, the financial outline explained above leads to a production cost that varies from USD 81,60/MWh to USD 69,0/MWh[26], not taking into account the R&D costs.

In order to avoid a large number of figures, we limited here ourselves to present results regarding the second case.

We have examined two alternatives for the use of the carbon rent.

VI.1 Recycling of the Carbon Rent in Rebates on Electricity Prices

The first alternative for assignment of the carbon rent leaves the financing modality unchanged and recycles the carbon rent in rebates on electricity selling prices. In that case the local State and the users are both winners, because in addition to the « developmental » rent they also take advantage of the tariff lowering and of the suppressing of subsidies on fuel. But the project is not reproducible for it depends on a financing at a rate of 0 % for one third of the initial investment cost.

The incidence of the carbon income on the price of electricity disposal is explained in table n° 8, taking a hypothesis of 25 USD a ton of CO_2[27]. The full recycling of the carbon rent

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23 The CDM Executive Board has nominated in June 2002 a 10 members Expert Panel to develop recommendations on guidelines for methodologies for baselines and monitoring plans.

24 Calculated on the basis of an investment of USD910/KW and of an IRR equal to the standard discount rate of 10 %

25 The subsidized price is of B $ 1.05/l when real cost is of B $ 3.05/l , that is about two thirds of subsidization.

26 In the second case, the totality of the production can be marketed, particularly on account of the building from the beginning of the connection Cojiba-Brasileia. In the first case, we have adopted a more pessimistic scenario where the connection will be only achieved in the year 4.

27 This hypothesis, which corresponded to a plausible value at the moment when the exercise was achieved using Business Plans simulation tools (that is before the withdrawal of the US from the Kyoto Protocol), may appear as high today, mainly because of the uncertainty regarding the management of hot air of the Economies In Transition (EITs), among which Russia. We can think though, that the position of the dominating monopoly of the EITs will lead them to try to maximize their carbon rent, and in this case, one should consider that the high levels of marginal emissions reduction abatement costs in other Annex 1 countries offer considerable possibilities for market prices to increase. In a recent pre-simulation exercise, the broker Natsource points out price forecasts varying from 0 to 45 USD/tCO2 in 2010 (Natsource, July 2002). Whereas Hourcade and Ghersi indicate a price range varying from 15 to 100USD/tC from pre-simulations made on 12 different price models (Hourcade and Ghersi, 2002)

in tariff rebates makes it possible to lower electricity prices from USD 69,0/MWh to USD 49,0/MWh, that is 29% cheaper.

Table n° 8 : recycling of the environmental rent in rebates on electricity selling prices.

Hypothetical international price of the avoided CO_2 ton	Assessment of the total international rent	rebate on electricity selling price
25 USD	0,76 Million of USD	- 20 USD/MWh

VI.2   Recycling the Carbon Rent to Attract a Private Investor

The second alternative recycles the carbon rent as an additional income every year, to verify that it would make it possible to reach a sufficient remuneration to enable a more classical financial set up.

The function of this recycling is to give evidence that the environmental rent coming from CDM would thus make reproducing of such a project possible.
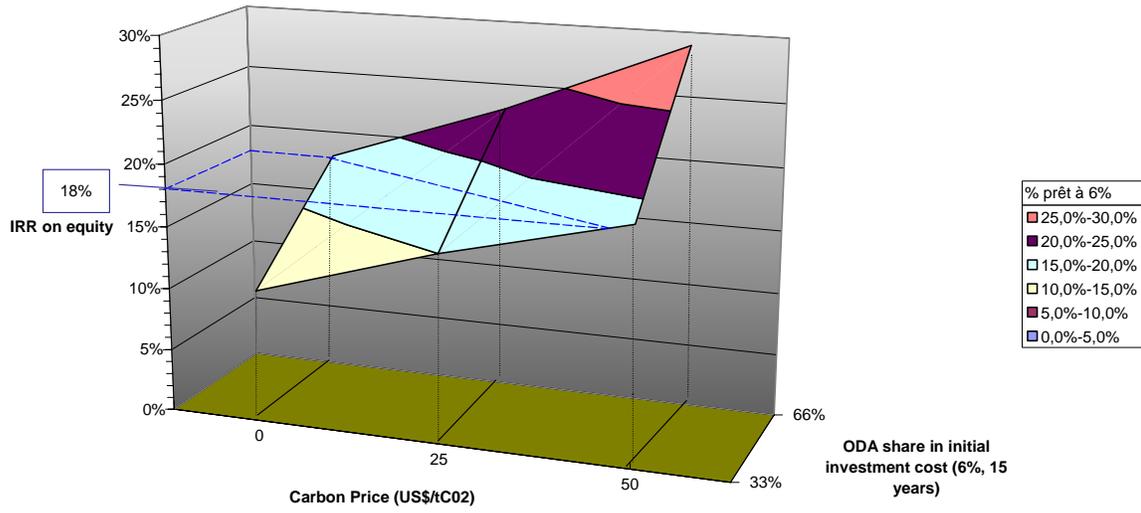
As a result the non profit-making financing brought by E7 is substituted by a classical capital contribution by a private investor, which should be remunerated at an attractive level. It means that the share of financing ensured through classical private financing increases from 1/3 to 2/3. Table n°9 present the IRR evolution in function of the same hypothesis of carbon valuation. One see that an hypothesis of USD 25,00/t CO_2 enables to reach a remuneration that is certainly not very high, but which remains acceptable for a conventional private investor in the electric sector.

The Bolivian State benefits, as previously, from a CDM rent by the suppression of fuel subsidizing, which he thus will be able to recycle in other programs. In the hypothesis of lower carbon prices on the international market, options to maintain an attractive level of capital remuneration could be (i) to increase the financing share under favorable conditions by development banks, or (ii) to obtain a financial participation from Bolivian Authorities, for instance by recycling a part of the saved subsidy.

Table n °9 : Viabilisation of a private investment by CDM carbon rent.

International price hypothesis of the avoided CO_2 ton	Return on equity
25 USD	15,0 %
0 USD	10,6 %

Moyenne TRI

IRR on equity

18%

30%
25%
20%
15%
10%
5%
0%

Carbon Price (US$/tC02)

0
25
50

66%
33%

ODA share in initial
investment cost (6%, 15
years)

% prêt à 6%
- 25,0%-30,0%
- 20,0%-25,0%
- 15,0%-20,0%
- 10,0%-15,0%
- 5,0%-10,0%
- 0,0%-5,0%

US$/tC02

VII. Annex 4: Other References Related to CDM Transaction Costs found in the Literature

Table n°10: Minimum transaction costs associated with the CDM project cycle

	CDM project cycle stages where costs are incurred	Estimate of cost (£)
Pre-operational phase design	Baseline study	12,000 – 15,000
	Monitoring plan	5,000 – 10,000
	Environmental assessment	Time & uncertainty
	Stakeholder consultation	Time & uncertainty
	Approval	Time & uncertainty
	Validation	10,000 – 20,000
	Legal and contractual arrangements	15,000 – 25,000
Operational phase	Sale of CERS	5% -15% of CER value.
	Adaptation levy	2% of the CER value annually
	Risk mitigation	1% - 3% of CER value annually.
	Verification	5,000 per audit

Source: Ecosecurities, "Clean Development Mechanism (CDM): Simplified Modalities and Procedures for Small - Scale Projects", (2002)

Table n°11: Baseline study costs as a fraction of 7-year CER revenues for four hypothetical CDM projects

	100 kW Village hydro mini-grid	10 MW Windfarm	200MW Hydro	200 MW Natural gas combined cycle plant
Assumed capacity factor	50%	30%	50%	80%
Total generation (000 MWh)	3	184	6,136	9,818
Baseline emission rate (tCO2/MWh)	0.6	0.6	0.6	0.6
Project emission rate (tCO2/MWh)	0	0	0	0.5
Credit rate (tCO2/MWh)[A]	0.6	0.6	0.6	0.1
CERs (million tCO2)	0.002	0.110	3.68	0.98
CER price	$3.00	$3.00	$3.00	$3.00
Value of CERs (7 years)[B]	$5,523	$331,335	$11,045,160	$2,945,376
Baseline study cost	$30,000	$30,000	$30,000	$30,000
Baseline study cost as percent of CER value	543%	9%	0.3%	1.0%

Notes:
A. Though illustrative only, 0.6 tCO2/MWh is a plausible value for many countries. It is very close to the build margin (weighted average of all recent plants) baseline for India in OECD/IEA 2000.
B. The total revenue is undiscounted. The baseline cost as a percentage of CER revenue would be the same on a discounted basis if the CER price were to rise at the rate of discount.

Source: OECD/IEA, "Practical recommendations for GHG mitigation projects in the electric power sector"

Table n°12: JI/CDM & Conventional Project Cycles & Estimated Additional Costs Associated with JI / CDM Projects.
Estimates presented in the " Manual for Project Developers. Manual for Joint Implementation and Clean Development Mechanisms" (DEA, 2002)

Conventional project activities	Additional JI/CDM activities	Estimated additional costs for JI and CDM (in EUR)
Project/business concept and feasibility activities	Additionality assessment including baseline study, calculation of emission reductions. Information for Project Idea Note and Project Design Document	20,000 - 50,000
Project planning and basic design activities	Monitoring plan	5,000 - 40,000 (depending on complexity of the project and sources of GHG emissions)
Project approval activities	Validation by independent or operational entity Host country JI/CDM approval	5,000 - 25,000 (depending on complexity, location of the project etc.)
Detailed design, procurement and final contracting activities	Marketing of credits	Internal costs or if external brokers are used payment is likely to be due when payments are received from buyer of credits – see below
Total		Total development costs 30,000-115,000
Construction / implementation of Project		
Production/operation, sales, maintenance, administration	Additional monitoring Verification	Unknown 3,000-15,000 per time
	Transfer of Carbon Credits	If brokers are utilised success fee in region of 3 -15% of ER value.
	Pay international administration levy – i.e. Registration with JI Supervisory Committee or CDM Executive Board	CDM: Percentage of CERs. Exact percentage is undecided. JI: No specified charge as yet but likely to make some sort of charge.
	Adaptation fee – Only applies to CDM projects	2% of CERs from CDM projects

Table n°13: JI / CDM Transaction Costs/Payments as estimated under and associated with current Carbon Credit Purchasing Programmes*

	Project proposal and Baseline	Validation	Comments
Prototype Carbon Fund (PCF) of the World Bank	22,000 EUR for baseline and 45,000 EUR for Monitoring Plan	33,000 EUR for validation	Average price paid is about 3.15 EUR per tCO_2
Dutch Eru-PT programme JI (May 2000)	22,689 EUR to 34,035 EUR	Maximum of 11,344 EUR	Verification costs for verification are not included
Dutch CERUPT programme Nov 2001 and ERUPT programme of Dec 2001	25,000 EUR	12,500 EUR	Costs for verification are not included

* the payments referred to in the table below do not necessarily present the actual costs, but represent the budgets paid by the PCF, ERUPT and CERUPT programmes

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Decision 15/CP.7 :Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol (http://unfccc.int/cdm/rules/modproced.html)

CDM Project Design Document (CDM-PDD) (2002) web link : MS-WORD zipped (22Kbyte) or http://unfccc.int/cdm/Documents/cdmpdd.zip

Small Scale CDM Expert Panel (2002):

"Recommendations for simplified modalities and procedures for small scale CDM project activities" (http://unfccc.int/cdm/Panels/ssc)

Annex A: Simplified project design document for small-scale CDM project activities

Annex B: Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories (http://unfccc.int/cdm/Panels/ssc/annexb.pdf)

Annex A: Simplified project design document for small-scale CDM project activities

Public comments invited by the CDM Executive Board received on: Annexes A, B and C of "Recommendations for simplified modalities and procedures for small scale CDM project activities"

- Mr. Koichi Kitamura (21 August 2002)
- Mr. Steve Seres (21 August 2002)
- UNEP, Collaborating Centre on Energy and Environment (22 August 2002)
- Osaka Gas Co., Ltd. (23 August 2002)
- Japan Gas Association (23 August 2002)
- Comments by Japan (23 August 2002)
- Comments by Australia (Australian Greenhouse Office) (23 August 2002)
- TERI (23 August 2002)
- Tokyo Gas Co., Ltd. (23 August 2002)
- Comments by Germany (23 August 2002)
- Ecosecurities (23 August 2002)
- Instituto Torcuato Di Tella (23 August 2002)
- The Pembina Institute for Appropriate Development (23 August 2002)
- Prototype Carbon Fund Plus Research Team (23 August 2002)
- Prototype Carbon Fund - World Bank (23 August 2002)
- Wageningen University (23 August 2002)
- Business Council for Sustainable Energy (BCSE) Annex B - Annex C (23 August 2002)
- International Emissions Trading Association (IETA) (30 August 2002)
- International Emissions Trading Association (IETA) - Addendum (4 September 2002)

Public comments invited by the CDM Executive Board received on CDM Project Design Document CDM-PDD

- Mr. Marc DeBlois (Ministry of Environment, Canada) (5 July 2002)
- Mr. Marc Darras (Gaz de France, Environment et Réglementation) (9 July 2002)
- Hamburg Institute of International Economics and GFA Terra Systems (10 July 2002)
- Tata Energy Research Institute (TERI) (10 July 2002)
- International Emissions Trading Association (IETA) (11 July 2002)
- Mr. Carlos E. Merenson (Ministerio de Desarrollo Social Secretarte de Ambiente y Desarrollo Sostenible, Argentina) (11 July 2002)
- Center for Clean Air Policy (CCAP) (11 July 2002)
- Ms Martina Bosi (IEA) (11 July 2002)
- Mr. Claude Culem (Holcin Group Support Ltd.) (11 July 2002)
- Mr. Frank Voehringer (Wageningen University) (11 July 2002)
- Transalta Corporation (11 July 2002)
- Mr. Hans Warmenhoven (PWC Global) (11 July 2002)
- Carboncredits.nl, Senter (11 July 2002)

- Prototype Carbon Fund (World Bank) (11 July 2002)
- World Business Council for Sustainable Development (WBCSD) (11 July 2002)
- Australian Greenhouse Office (12 July 2002)
- European Union (12 July 2002)
- Greenpeace International (12 July 2002)
- Mr. Donald Goldberg (CIEL) (12 July 2002)
- EcoSecurities (12 July 2002)
- The Business Council for Sustainable Energy (12 July 2002)
- Mr. Gyung-Ae Ha (Korea Energy Management Corp.) (12 July 2002)
- Comments by Bolivian Government (17 July 2002)
- Comments by Japanese Government (19 July 2002)

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PCF implementation note Number 4: Validation, verification and certification for PCF Projects, Version of April 21, 2000, 7 p.

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Baseline Study, Uganda: West Nile Electrification Project, December 4, 2001, 66 p.