DOCUMENTOS DE TRABAJO IELAT

Nº 30 – Septiembre 2011

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http://www.ielat.es/inicio/repositorio/Normas%20Working%20Paper.pdf

Impreso y hecho en España
Printed and made in Spain
ISSN: 1989-8819

Consejo Editorial

Clean Development Mechanism Projects in Latin America: Beyond reducing CO2 (e) emissions. A case study in Chile

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Abstract

The Clean Development Mechanism (CDM) was created to compensate underdeveloped countries for their contribution to mitigate climate change. Under these rules, those projects showing the lower cost, in terms of investment, for each tonne of CO2 (e) saved, will be the ones selected. However, even if this selection process seems quite rational, it can result in a suboptimal allocation of resources, when other impacts of these projects, also having to do with social welfare, are considered. This point is illustrated in this paper by comparing the financial cost of CER credits of two current CDM projects in Chile, the Santa Marta Landfill Gas Capture Project and the Corneche-Los Guindos Methane Capture from Swine Manure Project, with that of a third, "virtual" project, the upgrading of the Renca Generation Plant in Santiago de Chile to a gas fired combined cycle (CCGT) Plant. Even if this third project is much less efficient in financial terms, it shows a very important ancillary benefit: its impact on human health. When this impact is introduced, the result, as expected, is a drastic change in the relative social profitability of the three projects.

Keywords:
Clean Development Mechanism; Health Impacts; CER

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Introduction

The Clean Development Mechanism (CDM) was created from Article 12 of the Kyoto Protocol to allow underdeveloped countries to promote "green investments" and help them to acquire clean technology and foreign exchange, as a compensation for their contribution to mitigate climate change.[1] It became operational in early 2006. The mechanics of the process are only too well known: after having been approved by the host country Designated National Authority (DNA), and duly certified by an independent Designated Operational Entity (DOE), those projects finally approved by the CDM Executive Office in Montreal would get a certain amount of Certified Emission Reductions credits (CER) that can be traded in the appropriate markets, e.g: the European Union Transfer Credit System (see, for instance, Azqueta, 2007, pp 327-329). From a financial point of view, and once the "additionality" requirement has been met, those projects showing the lower cost, in terms of investment, for each tonne of CO_2 (e) saved, will be the ones first selected. However, even if this selection process seems quite rational, it can result in a suboptimal allocation of resources, when other impacts of these projects, also having to do with social welfare, are considered. This point will be illustrated by comparing the financial cost of CER credits of two actual CDM projects, with that of a third, "virtual" project, much less efficient in financial terms, but showing a very important ancillary benefit: its impact on human health. In order to do so the paper is structured as follows. The first section presents the two CDM projects in Chile that are already at the CDM Executive Office: the Santa Marta Landfill Gas Capture Project and the Corneche-Los Guindos Methane Capture from Swine Manure Project.

A third project, the "virtual" CDM project, is also introduced, for illustrative purposes: the upgrading of the Renca Generation Plant in Santiago de Chile to a gas fired combined cycle (CCGT) Plant. Section 2 compares these three projects in terms of their financial profitability: the required price of the CER that would make them worthwhile. Section 3 introduces another aspect of these three projects also having to do with social welfare: their impact on human health. Two of the three projects are located in the Santiago de Chile metropolitan area, and have an impact on PM10 emissions. Taking into account that Santiago de Chile suffers from very high pollution levels, this impact is relevant indeed. After having identified, quantified and valued in monetary terms these impacts with the help of the AIRPACTS Model, simply as an illustration, Section 4 once again compares the relative profitability of the three projects, introducing health impacts into the analysis. The result, as expected, is a drastic change in the relative social profitability of the three projects. The paper is concluded with a set of recommendations directed to the corresponding Designated National Authority.

[1] Even if it is open to discussion following Copenhagen, we assume that Kyoto II will retain the same basic structure as Kyoto I. For a very interesting reform proposal, however, see Verbruggen (2009).

1. Three CDM Projects in Chile: A brief description

The CDM mechanism has been well below expectations during the few years that it has been in operation, both in terms of the number of projects approved and the amounts of CER awarded. A few Latin American countries have been active in this market, together with the two main players: India and China. Chile, together with Brazil, Colombia, Costa Rica and various others, belong to this small group. Furthermore, Chile has put well developed and functioning administrative machinery into place, that is able to cope with the CDM process, centred around CONAMA, the National Environmental Commission. However, even if CONAMA is performing an adequate job in this respect, there is something else it can do to greater increase social welfare: instead of simply certifying those CDM projects that are entitled to it, it could select those among them that have the greatest impact on social welfare, by considering not only their efficiency in lowering CO_2 emissions, but also, for instance, their impact on local pollution and, consequently, on human health.

This point will be illustrated next, looking at three such projects. After a brief description, their efficiency in financial terms will be assessed.

1.1 *Santa Marta Landfill Gas Capture (LFG) Project*[2]

The main objective of the first project was to capture the emissions of the Santa Marta Landfill.

The Santa Marta Landfill is located in the Santiago de Chile Metropolitan Area and gives service to a population of approximately 1.2 million people in the Southern area of the capital. It covers a total of 296 hectares, 77 of which are devoted to storing domiciliary solid waste (11 are already occupied with an average height of 50 meters). It receives an average of 48,600 tonnes every month, and it is planned to be in use until 2022.

The CDM Project consists in the installation of a highly efficient landfill gas collection system that will involve investing in a gas collection system, airtight covering of the landfill, and flaring equipment. The costs of the project could be summarized as follows: US $ 30,000 in 2005 required for the feasibility studies and another US $ 6 million in 2007 as the costs of investment as such. Discounting these figures to the year 2000 in order to compare all three projects, using a 2% rate of discount, the Present Value of this cost is US $ 5,250,533.[3]

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[2] See http://cdm.unfccc.int/Projects/DB/DNV-CUK1165902714.87/view . Visited the 30th of July 2011.

[3] 2% may seem rather low a value, even for the *social* rate of discount, but, taking into account that what matters is the comparison between the three projects, changing it would not alter the main conclusion of this paper.

It was considered that the current practice regarding landfill management in Chile should be treated as the baseline of the project: the baseline is usually estimated through reference to emissions from similar activities and technologies in the same country or in other countries. This baseline included, in any case, the obligation, enforced by the Chilean Environmental National Commission (CONAMA: Resolution of Environmental Qualification RCA 509/2005) to capture and destroy a determined amount of LFG per year (751,751 tCO_2 (e) during the 16 years of the project. As there was no further obligation regarding LFG capture, and no financial incentive to do so (electricity generation was not viable), the project complied with the "additionality" clause required for CDM projects.

Based on the US EPA LANGEM (First Order Decay Model)[4] and with the help of a linear extrapolation of biogas and CO_2 (e) emissions, the following figures were obtained regarding avoided CO_2 (e) emissions due to the project:

Table 1: Santa Marta Landfill Project: CO_2(e) emissions avoided

	Emissions avoided (Tm)
Period 2007-2013	1,735,598
Period 2014-2020	3,194,752
Period 2021-2027	3,711,593
Total	8,641,943

Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1165902714.87/view

The project was presented to the CDM Designated National Authority (CONAMA, the Environmental National Commission) in December 2006.

1.2. *Methane capture and combustion from swine manure treatment for Corneche and Los Guindos*[5]

Agrícola Super Limitada (Agrosuper), the largest pork production company in Chile (8th in the world) presented a project to implement an advanced waste management system (anaerobic and aerobic digestion of hog manure) in order to reduce greenhouse gas emissions into the atmosphere in two of its farms: Corneche and Los Guindos in the province of Melipilla, close to the Santiago Metropolitan Area.

[4] http://www.epa.gov/ttn/catc/products.html.software
[5] http://cdm.unfccc.int/Projects/DB/DNV-CUK1120198039.1/view

The CDM Project consists of an advanced improvement to the common practice of swine waste treatment, reducing an important amount of greenhouse gases. The technology implemented is based on the use of anaerobic, ambient temperature, complete-mix digesters, coupled with a flare to burn surplus biogas. The total costs of the project, as presented by *Agrosuper*, was US $ 722,916 in the case of Corneche, and another 932,844 for Los Guindos, both taking place in 2006. These US $ 1,655,760 discounted as before, would have a Present Value of US $ 1,470,267 in the year 2000.

The project was presented to CONAMA in July 2004. The baseline was considered to be, as in the previous case, the usual practice in Chile regarding swine waste treatment: use of open stabilization lagoons. A potential baseline was also contemplated: Press (Solid Separation)-Anaerobic Lagoon-Land Application.

There was no economic benefit to be found from installing this advanced waste treatment system, and, therefore, no financial incentive to undertake the project, and as such the project also complied with the additionality requirement.

The amount of CO_2 (e) reductions achieved by the project (because of the transformation of methane in CO_2) is shown in the following table.

Table 2: Corneche-Los Guindos Project: CO_2(e) emissions avoided

	Emissions avoided (metric tonnes)
Period 2002 – 2008	588.581
Period 2009 – 2015	637.329
Period 2016 – 2022	637.329
Total (2002 - 2022)	1.863.239

Source: http://cdm.unfccc.int/Projects/DB/DNV-CUK1120198039.1

The project was also approved by the CONAMA.

1.3 *Substituting clean fuel at Renca Electricity Generation Plant*

Contrary to the two previous cases, although also based on actual data, this is a "paper" or "virtual" project that identifies some of the major shortcomings of the conventional way to assess CDM projects.

Essa Renca is an oil fired Electricity Generation Plant, located inside the city of Santiago that produces electricity, 539 MW, with the help of two main steam generators.

The CDM Project would consist in completely upgrading the current plant, converting it into a gas fired combined cycle (CCGT), substituting natural gas for the fuel (diesel) currently in use. The fact that this is not just a possibility but an alternative already contemplated by Chilean authorities makes the development of the comparison much easier.

Table 3 reflects the main characteristics of the new plant, once upgraded.

Table 3: New Renca Plant: Production

Central	Power (MW)	Production (MWh/year)	Net Production MWh/year (40% efficiency)
Renca	160	1.401.600	560.640
Nueva Renca	379	3.320.040	1.328.016
Total	539	4.721.640	**1.888.656**

Source: own elaboration based on the EIA of the project: http://seia.sea.gob.cl/busqueda/buscarProyectoActionNEW.php?modo=ficha&nombre=renca&sector=&regiones=&presentacion=EIA.

The emission levels associated with the new Plant would likely correspond with those found in Table 4.

Table 4: New Renca Plant: Emissions

Inventory Emissions				
	EPA Rate (kg/MWh)		Emissions (tonnes/year)	
	NOX	SO2	NOX	SO2
Renca			432	28
Nueva Renca	0,77	0,05	1.023	66
		Total	1.454	94

Source: *ibidem*

The estimation of the investment costs of this project is based on the information given to the CONAMA in February 2002, when, as mentioned, such a possibility was considered, and had to undergo the perceptive Environmental Impact Assessment process: US $ 122,900,000.[6] Discounted to the year 2000, this would be equivalent to US $ 118,127,600.

Assuming that the actual generation process could be accepted as the baseline, and taking into account that a conventional diesel plant emits a total of 752g of CO_2

[6] www.e-seia.cl (October 2008)

per KwH, whereas a combined cycle plant lowers this figure to 350g, the amount of CO_2(e) reductions that would have been achieved with this "virtual" project is shown in Table 5.

Table 5: Renca Generation Plant Project: CO_2(e) emissions avoided

	Emissions avoided (metric tonnes)
Period 2002 – 2008	2,465,054
Period 2009 – 2015	2,465,054
Period 2016 – 2022	2,465,054
Total (2002 - 2022)	7,395,192

Source: *ibidem*.

This project has obviously not been presented as a CDM project, nor has it been approved by the Designated National Authority: CONAMA. The reason will be given shortly.

2. Financial Assessment of the three projects

The above information is sufficient to perform an elementary financial appraisal of the three projects: we only need to look at the amount of CO_2 (e) reductions achieved, and compare it with the total investment costs of the project. This will give as a result the required unitary cost of each CER: the cost of each tonne of CO_2 (e) avoided, or, alternatively, the CER price that would allow the covering of this cost. This is the information given in Table 6.

As it can be seen from this Table, the Renca Project (the "virtual" project) compares very poorly in terms of financial efficiency with either of the other two: the price of the CER required to cover its costs is more than ten times that of its competitors: 15 dollars instead of either 60 or 80 cents. This result is quite consistent with the fact that moving from the cost-efficient point to the carbon-efficient point may be really expensive (Welch and Barnum, 2009). Thus, if only financial considerations were to be taken into account, there would be little doubt as to which project would be last in the pipeline.

Table 6. Financial assessment of the three projects (US $ 2000)

	Santa Marta	**Corneche-Los Guindos**	**Renca**
Investment Costs	5,250,533	1,470,267	118,127,600
CO_2 (e) reductions (metric tonnes)	8.641.943	1.863.239	7.395.192
Required price of CER (US dollars)	0,61	0,79	15,98

Source: own elaboration from the previous tables.

These three projects, however, do not only have a positive impact upon climate change, they also influence social welfare in other various forms. One of these which is very relevant in this case, is its impact on public health.

3. CDM projects and human health

Santiago de Chile is a highly polluted city. The data on PM10 displayed in the following table corroborates this assertion.

Table 7. Santiago de Chile, PM10 concentration (μg/m^3): 1997-2007

	1997	1999	2001	2003	2005	2007
PM10 annual	97	80	71	75	66	70
PM10 24 hr	317	269	229	219	183	233

Source: *CONAMA Metropolitana de Santiago de Chile* (2008).

These values are well above the international recommended levels: 50 μg/m^3 daily annual average, or 150 μg/m^3 for 24 hour average. Certainly, an increase in PM10 emissions in a polluted city like Santiago would have a negative impact on human health.

In this respect, however, two of the three projects previously analysed have significant impacts upon the quality of the air in the Metropolitan region of Santiago and, therefore, upon public health: the Santa Marta landfill project adds to the already high levels of PM10 concentrations, whereas the Renca Project reduces them substantially. Corneche-Los Guindos has neither a positive nor a negative impact on PM10 emissions in the city of Santiago due to its location.

It could be the case that sometime in the future, the impact on local pollution of these activities will be taken into account, and those more harmful penalized accordingly: for instance, as has been suggested, through a carbon budget restriction (Salon et al, 2010). Meanwhile, however, it is perhaps worthwhile to analyse these impacts in some more detail.

As mentioned above the Santa Marta landfill project adds to the already high levels of PM10 existing in the city of Santiago. Based on the isochinetic emissions sample carried out in the flares during the Environmental Impact Assessment process, the following figures were obtained:

Table 8. Santa Marta landfill Proyect: PM10 annual emissions (2007-2027)

Year	Biogas generation (50% efficiency) (m3/hour)	PM10 (tonnes/year)
2007	3,378	2.89
2009	4,62	3.96
2011	5,838	5.00
2013	7,033	6.03
2015	8,185	7.01
2017	9,3	7.97
2019	10,387	8.90
2021	11,45	9.81
2023	11,389	9.76
2025	10,305	8,83
2027	9,324	7.99
Annual average		7.21

Source: Environmental Impact Assessment:
http://seia.sea.gob.cl/busqueda/buscarProyectoActionNEW.php?modo=ficha&nombre=santa%20marta%20&sector=&regiones=&presentacion=EIA&buscar=true

Transforming the Renca Generation Plant into a combined cycle type one would lower PM10 emissions in the city of Santiago.

Would it be possible to evaluate in economic terms the relative welfare change associated to these two projects regarding their impact on human health?[7]

[7] Even if important, the relevance of the timing of the abatement measures upon both costs and ancillary benefits, is ignored here for simplicity. See Kuosmanen *et al*., (2009) on this issue.

The answer is, certainly, positive.

As it is only too well known, economic analysis provides different methods to identify and value, in monetary terms, changes in human morbidity and mortality: see for instance Azqueta (1994, chapter 8) for a general overview, and Pearce et al (2006, chapter 14), and Palmer et al (2007) for an application to the electricity sector. The ExternE Project is also a very good practical example of the application of these techniques (http://www.externe.info).

Taking into account the purely illustrative purpose of this note, there would be no point in attempting to fully apply these methods here, something that goes far beyond the level of research of this paper. Instead, we can try to apply a simple version of the AIRPACTS Model developed, precisely, to value the main externalities produced in the electricity generation processes (Spadaro, 2002).

The AirPacts program measures the consequences to human health, agricultural crops and man-made environments (building materials) from exposure to atmospheric emissions. As Spadaro indicates: "AirPacts employs a simplified impact assessment methodology that is transparent, easy to use and requires limited input data. In the simplest approximation, only the population density for a circle centered at the source and with radius 500 to 1000 km is needed to predict the impact. Compared to detailed assessments, AirPacts results are typically accurate to a factor of two. The program calculates the damage costs for the following pollutants: particulate matter (PM), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), and secondary species such as nitrate and sulfate aerosols. The burdens to human health are assessed by an analysis of impact pathways (IPA). The IPA approach begins by identifying the physical characteristics of the source and preparing a detailed inventory of airborne releases. Separate atmospheric dispersion models are used to calculate the marginal increment in air concentration. Locally (< 50 km from the source), dispersion of primary pollutants (species emitted at the source) is influenced by stack parameters and weather data. A Gaussian plume model is used to estimate concentrations. Beyond 50 km, chemical transformation, dry deposition and precipitation deplete the pollutant from the air. Regional concentrations can be predicted using Eulerian or Lagrangian transport models such as the Windrose Trajectory Model used in the EcoSense program of the ExternE study of the European Commission (Krewitt et al., 1995). Impacts are quantified using Exposure Response Functions (ERF), which relate pollutant concentration to the resulting impact on a receptor (health, crop, etc.) ERFs for health impacts are derived from a survey of epidemiological studies (Rabl 2001). In view of the available evidence, it is assumed that ERFs for health are straight lines with no threshold, at least not on a population wide level and at current ambient concentrations. Impacts on human health include respiratory effects (asthma attacks, hospital admissions, etc.) and premature deaths. Mortality impacts are quantified in terms of the reduction in life expectancy, expressed as cumulative Years of Life Lost (YOLL) for the population at risk" (Spadaro, 2002, pp. 3 and 4).

This simple model can therefore be applied to both the present situation, and a new Renca Plant working entirely on natural gas, just for illustrative purposes.

To do so, a comprehensive set of data regarding emissions from the plant in both scenarios is required. This information appears in Table 9 and shows the official figures provided by the Chilean Authority.

Table 9: Renca Plant: Emissions.

Unit	PM (t/year)	NOx (t/year)	SO_2 (t/year)
Renca (Diesel)	98,41	654,67	1,43
Nueva Renca (Diesel)	64,73	634,33	-
Total	163,14	1.289,00	1,43

Source: as in Tables 3, 4 and 5.

This emission data needs to be introduced into the model taking into account the different depletion velocities of each pollutant. In this case, the depletion velocities characterizing the atmospheric pollutant removal rate for South America were selected: PM10 (2,86 cm/s), SO2 (2,08 cm/s), NOx (2,26 cm/s), Sulfates (4,76 cm/s) and Nitrates (3,00 cm/s) (Spadaro, 2002).

In addition, data regarding population density in the area, as well as cases of infant mortality, hospital admissions due to heart and respiratory diseases, chronic bronquitis and restricted activity days is also required. This data was taken from the official statistics of the Chilean National Statistics Institute, the Ministry of Public Health and other sources.

The main result of applying this model would be the following:

The economic costs of the loss of welfare associated with the impact on people´s health of the emissions from the Renca Plant, as it is now, would reach 27,134,746 dollars per year.

The comparable welfare loss of the new, upgraded Renca Plant, would amount to 4,128,100 dollars per year.

Therefore, completely transforming the current Renca Plant into one working with natural gas would represent a social benefit of more than 23 million dollars per year due to this improvement in public health.[8]

[8] Some years ago, Raúl O´Ryan and other scholars presented a study on the social welfare consequences of closing the Renca plant (O´Ryan *et al*., 2005). The main positive impact of this closure would be, as expected, the improvement in people's health due to lower concentrations of PM10. Based on existing dose-response functions, and applying the most relevant economic value for different losses, they arrived at the figure of US $ 13,511,136. This value, even if lower than the one obtained with the help of AirPacts, is within an acceptable range.

As mentioned previously, the Santa Marta landfill project, instead of diminishing PM10 concentration in the city of Santiago, adds to the already existing high levels. It could be assumed, for simplicity, that these emissions would have the same negative impact as a similar amount emitted at Renca, despite the difference in location and, consequently, in dispersion factors. In this case, and following the same methodology as above, the economic value of the welfare loss associated to this increase in PM10 emissions would reach an average annual cost of US $ 1,082,841. If however, and due to any reason (different dispersion patterns for instance), it is considered that these emissions would have no impact whatsoever on public health in Santiago, then this cost would amount to zero. Therefore, the negative impact upon public health of the Santa Marta CDM project would lie somewhere in the range of US $ 0-1,082,841.

A final caveat should be mentioned here. As Yang (2006) points out, fossil fuel combustion generates not only CO_2 but also SO_2. SO_2 can cause serious local pollution problems but it can alleviate the problem of global warming as well, because of negative radioactive forcing. This second impact has not been taken into account in this exercise for simplicity.

4. Including the social costs and benefits of the CDM project's impacts on public health

It would be fairly easy now to compare the relative social convenience of the three projects where, instead of taking into account only their positive impact on climate change via CER, their impact on human health, associated to PM10 emissions, is also considered. The following table shows the relative performance of the three projects:

Table 10. Social appraisal of the three projects: climate change and health impacts

	Santa Marta	Corneche-Los Guindos	Renca
CO_2 (e) emissions avoided (metric tonnes)	8.641.943	1.863.239	7.395.192
PM10 Emissions (metric tonnes/year)	7,21	0	- 67,4
Public health benefits associated to PM10 emissions (US $ / year)	(0; - 1,082,841)	0	10.122.533
Required price of the CER (US $)	(0.61 ; 2,67)	0,79	-34,98

Source: own elaboration from previous tables.

The main conclusion from these figures is straightforward. When considering their impacts on public health together with their positive contribution to climate change, the relative attractiveness of these projects changes drastically. Now, in the worst case, the Santa Marta landfill project requires US $ 2.67 per CER, instead of US $ 0.61, to cover all its costs, because of the negative impact on public health due to higher PM10 emissions. If there is no such negative impact, then the required cost of the CER would still be US $ 0.61. The project remains attractive in both cases, if the volatility of CER prices is put aside (Del Río, 2006). On the other hand, due to this positive impact on the citizens of Santiago de Chile, the Renca project is associated to lower PM10 emissions, and is now socially acceptable, even in the absence of CER payments.[9] Not only is this true, but it should also be strongly preferred to any of the two alternatives in terms of a Social Cost-Benefit Analysis.[10] Yet, it would hardly be undertaken in the absence of some public support: as Coria (2009) clearly showed, utilities are more sensitive to the cost of energy than to environmental regulation at large. Taking into account the problems associated with the gas supply from Argentina, gas prices are unlikely to fall in the medium term.

This fact should have some practical implications.

CDM projects have experienced a lower than expected development, and many causes have been pointed out in trying to explain this failure. The constant revision of the methodologies, long response times and complex registration procedures (Olsen and Fenham, 2008), together with low administrative capacity and logistic problems of the Designated National Authority (Ellis and Kamel, 2007) are high among them. This is certainly not the place to deal with these shortcomings, and far from our intention to add further difficulties to the already demanding work of the DNA. Yet, even taking into account these restrictions, we would like to argue in favour of a revision of the selection process regarding CDM projects. At a global level, as it has been widely argued, this process should extend eligibility to additional land use, land-use change and forestry projects (Kneteman and Green, 2009). At a national level, however, and this is the main point of this paper, the selection process should also take into account some local impacts that may be even more important, in terms of social welfare, than GHG emission reductions themselves. CONAMA, in this case, should then perform a more comprehensive cost benefit analysis of the CDM proposals, and select those that have a higher impact on social welfare, even if they are not the ones most effective from a purely financial perspective. Afterwards, it would be perhaps convenient for the corresponding DNA to receive the credits, and use them to support these sectors, as it has been argued (Schneider and Cames, 2009), but this is in any case another issue.

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[9] Taking into account, however, that no financial reward to the owner of the plant is linked to this positive impact, the project would in any case still comply with the “additionality” requirement

[10] If instead of the AirPacts figure we would adopt the one offered by O´Ryan et al (2005, see footnote 6), the corresponding CER price for the Renca Project would be US $ -14, still very attractive.

5. Conclusions

CDM Projects can be of some help, both in contributing to mitigate climate change and in allowing developing countries to acquire clean technologies and earn foreign exchange. Nevertheless, taking into account the characteristics of many of these projects, and focusing only on their effectiveness in reducing CO_2 (e) emissions may be unduly restrictive. As the Designated National Authority has to finally approve the projects that will follow the process up to the Clean Development Mechanism Executive Office in Montreal, it should broaden the scope of the analysis so as to include other impacts that could be even more important from the social welfare point of view. An example of such a case, although not the only one, is human health. This has been illustrated in this paper with the help of a little exercise that compared three projects: two current CDM projects, *Santa Marta Landfill Gas Capture (LFG)* and *Methane capture and combustion from swine manure treatment for Corneche and Los Guindos*, with a third, hypothetical project, the *upgrading to a CCGT of the oil fired Renca Electricity Generation Plant*. In terms of efficiency in reducing CO_2 (e) emissions, the two CDM projects clearly outperformed the upgrading of the generation plant: the cost of each CER produced was more than ten times lower. However, if the impact of these projects upon the health status of the citizens was also to be considered, the relative situation of the three projects would be completely reversed: now, the upgrading of the Renca Power Plant is by far, the most preferred project from a social perspective. The main conclusion of this paper would thus be, that the DNA should give priority to these CDM projects that have the greatest impact on social welfare, per unit of investment, even if they are not the more financially attractive projects, i.e.: the most efficient in reducing GHG emissions.

References

Azqueta, D. (1994). *Valoración económica de la calidad ambiental*. Madrid, Mc Graw-Hill, 299 pp.

Azqueta, D. (2007). *Introducción a la Economía Ambiental*, 2ª ed. Madrid, Mc Graw-Hill, 499 pp.

CONAMA Metropolitana de Santiago de Chile (2008). *Anteproyecto de revisión, reformulación y actualización del Plan de prevención y de Descontaminación Atmosférica para la Región Metropolitana (PPDA) año 2008*. July 2008.

Coria, J. (2009). Environmental policy, fuel prices and the switching to natural gas in Santiago, Chile. *Ecological Economics*, 68 (11): 2877-2884.

Del Río, P. (2006). Linking renewable energy CDM projects and TGC schemes: an analysis of different options. *Energy Policy*, 34: 3173-3183.

Dutschke, M. and A.Michaelova (2006). Development assistance and the CDM – how to interpret 'financial additionality'. *Environment and Development Economics*, 11 (2): 235-246.

Ellis, J. and S. Kamel (2007). Overcoming barriers to CDM projects. Analytical Paper. Climate Change Expert Group of the UNFCCC.

Kneteman, C. and A. Green (2009). The Twin Failures of the CDM: Recommendations for the "Copenhagen Protocol. *The Law and Development Review* 2 (1), Article 9.

Krewitt, W., A. Trukenmueller, P. Mayerhofer and R. Friedrich, "ECOSENSE - An Integrated Tool for Environmental Impact Analysis", in Kremers & Pillmann (Eds.), *Space and Time in Environmental Information Systems*, Umwelt-Informatik aktuell, Band 7, Metropolis-Verlag, Marburg, 1995, pp. 880.

Kuosmanen, T., N. Bijsterbosch and R. Dellink (2009). Environmental cost-benefit analysis of alternative timing strategies in greenhouse abatement: A data envelopment analysis approach. *Ecological Economics*, 68 (6): 1633-1642.

Palmer, K., D. Burtraw and J-S Shih (2007). The benefits and costs of reducing emissions from the electricity sector. *Journal of Environmental Management*, 83: 115-130.

Pearce, D., G. Atkinson and S. Mourato (2006). *Cost-Benefit Analysis and the Environment: Recent Developments.* Paris, OECD Publications, 315 pp.

Olsen, K.H. and J. Fenham (2008). *A reformed CDM - including new Mechanisms for Sustainable Development*. UNEP Riso Centre, Roskilde.

O'Ryan, R. (2005). Evaluación de beneficios ambientales. *Integrated Environmental Strategies, Programa de Gestión y Economía Ambiental*, Working Paper, Departamento de Ingeniería Industrial, Universidad de Chile.

Rabl, A. (2001). *Reference Database of Concentration-Response Functions for Health Impacts of Air Pollution*. Report for the International Atomic Energy Agency, Vienna, Dec. 2001.

Salon, D., D. Sperling, A. Meier, S. Murphy, R. Gorham and J. Barrett (2010). City carbon budgets: A proposal to align incentives for climate-friendly communities. *Energy Policy*, 38 (4): 2032-2041.

Schneider, L. and M. Cames (2009). A framework for a sectoral crediting mechanism in a post 2012 climate regime. Report for the Global Wind Energy Council, Berlin, 28 May 2009. Oko Institut e.V. Institute for Applied Ecology.

Spadaro, J.V. (2002). *AIRPACTS MANUAL (Version 1.0): A tool for assessing the environmental impacts and damage costs to human health, agricultural crops and man-made structures from exposure to routine atmospheric emissions*. International Atomic Energy Agency (IAEA), Vienna, Austria.

Verbruggen, A. (2009). Beyond Kyoto, plan B: A climate policy master plan based on transparent metrics. *Ecological Economics*, 68 (12): 2930-2937.

Welch, E. and D. Barnum (2009). Joint environmental and cost efficiency analysis of electricity generation. *Ecological Economics*, 68 (8-9): 2336-2343.

Yang, Z. (2006). Negatively correlated local and global stock externalities: tax or subsidy? *Environment and Development Economics*, 11 (3): 301-316

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