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BRAZILIAN CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS: GENERATION OF CLEAN TECHNOLOGIES AND SUSTAINABLE DEVELOPMENT?

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Resumo
Uma das inovações do Protocolo de Kyoto foi a estipulação de mecanismos que visam à cooperação entre os países para a mitigação das mudanças climáticas. Apenas o Mecanismo de Desenvolvimento Limpo (MDL) permite a participação de países em ddesenvolvimento. O presente artigo busca avaliar a contribuição dos projetos de MDL brasileiros, ligados à Indústria de Energia e que haviam recebido créditos de carbono até 2007, para a geração de tecnologias limpas e a promoção do desenvolvimento sustentável. A partir da análise de conteúdo dos documentos de concepção de 37 projetos, chega-se a conclusão que essa contribuição é ainda incipiente: somente 3% podem ser caracterizados como projetos focados em desenvolvimento de tecnologias e práticas de produção mais limpa; os projetos analisados atendem parcialmente a 2 (dois) dos 5 (cinco) critérios estabelecidos pela Comissão Interministerial de Mudança Global do Clima para avaliar a contribuição do MDL para o desenvolvimento sustentável. Assim, pode-se afirmar que o MDL está longe de atingir o seu propósito fundamental de minimizar as mudanças climáticas e estimular um modelo de desenvolvimento mais limpo através da cooperação entre países industrializados e em desenvolvimento.

Palavras-chaves: Mecanismo de Desenvolvimento Limpo (MDL), Desenvolvimento Sustentável, Tecnologias Limpas, Industria Brasileira de Energia.

1. INTRODUCTION

Higher temperatures year after year. Melting of polar caps. Rise of the sea level up to cover entire islands. Complete lack of control of the terrestrial biodiversity. These are some the alarming previsions echoed by scientists and environmentalists all over the world, if the climate phenomenon, Global Warming, does not come to an end.

The raise in the Greenhouse Gases (GHG) emissions into the Earth's atmosphere, given to the economic and demographic growth that occurred in the past centuries, especially after the Industrial Revolution, is causing temperature to change more intensively rather than the natural variation that has always affected the climate. This cause can be attributed to the "greenhouse effect". In 1998, for a better understanding of this phenomenon, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) created the Intergovernmental Panel on Climate Change (IPCC) aiming to gather the main scientists of the world for scientific research cooperation (Grau-Neto, 2007). Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy, although they need to deal objectively with policy relevant to scientific, technical and socio-economic factors. They should be of high scientific and technical standards, and aim to reflect a range of views, expertise and wide geographical coverage (*Intergovernmental Panel on Climate Change*, 2009).

From these evaluations, in 1997, during the 3rd Conference of the Parties, the international community creates the Kyoto Protocol, a multilateral agreement that stipulates real targets for emission reduction of GHG to the developed countries, integrating the so-called Annex I[1] of the protocol (Veiga, 2008). The Kyoto Protocol offers the parties an additional means of meeting their targets by way of three market-based mechanisms: Joint

[1] The Kyoto Protocol divides the countries in Annexes, according to the stipulation of target reduction, mandatory or not. The countries with reduction targets are the "Annex I", consisting of two subgroups – countries of "Annex II", which are the industrialized nations, a group very similar to the Organisation for Economic Co-operation and Development (OECD), and the countries called "Economies in Transition", covering the Eastern Europe countries and the majority of the former Soviet Union's countries; and the "Non-Annex I", a category constituted of the developing countries, which Brazil is a member of, without defined targets for the first valid period of the protocol, i.e., within 2008 and 2012.

Implementation (JI), that permits that industrialized countries compensate their emission financing reduction projects in other industrialized countries; the Emissions Trading (ET) that allows countries to exchange their allowed emissions; and the Clean Development Mechanisms (CDM) that allows that industrialized countries achieve their individual targets by projects implemented in developing countries (Valente *apud* Goldemberg, 2005). The CDM becomes especially important in the world scenario, because it is the only one that allows the participation of developing countries that still do not have defined targets for the first commitment period of the Kyoto Protocol, which finishes in 2012.

For the activities proposed by the CDM projects to be considered eligible some fundamental criteria must be observed: first, the additionality, which presumes the proof of effective reduction of GHG and/or removal of additional CO_2, justifying whether or not the GHG reduction would have occurred in the absence of the project. Secondly, the contributions of the project to the host country in terms of sustainable development by means of environmentally sound technology transfer (Lopes, 2002). These criteria were defined after long negotiations among the Protocol's signatory countries, aiming to assure, not only the contribution by the developing countries in minimizing the global climate change, whose responsibility bears on the developed or industrialized countries, but its attempt in incorporating a new development model, that purposes a real integration of the countries for a team solution to face a problem that affects all of us in different ways.

The search for alternatives for the development of countries in a global and sustainable way has been done in United Nations' sphere, mainly after the publication of the Brundtland Report[2]. The concept was not forgotten during the writing of the Kyoto Protocol. In its article 10, that restates the paragraphs 3, 5 and 7 of the United Nations Framework Convention on Climate Change (UNFCCC), the agreement emphasizes the necessity of cooperation between developed and developing countries to achieve its main target: the fulfillment of the quantified commitments of GHG emission reduction, in order to promote the sustainable development. For that, an effective participation of governmental and non-governmental actors (among them, the corporate actors) of all world nations is necessary.

Thus, considering that one of the main objectives of the CDM is to promote the sustainable development of the countries that are out of the Annex I, by means of environmentally sound technologies transfer, and, taking into consideration that the

[2] It is a report called "Our common future", published in 1987, and elaborated by an international commission headed by Gro Harlem Brundtland, then prime-minister of Norway (Cairncross, 1992:58).

generation of clean technologies is the most efficient strategy for reaching these targets, this article has the following research problem: Is this mechanism being efficient in promoting the sustainable development and in generating clean technologies in Brazil?

This analysis is especially important considering that, nowadays, Brazil is the third biggest proponent of CDM projects in the world (11.33%), only behind of India (29%) and China (27.3%) (*United Nations Framework Convention on Climate Change*, 2009). At the moment, the Brazilian projects are focused on the following sectoral scopes: renewable energy (50%), pig farming (15%) and the substitution of fossil fuel (13%). Besides these activities, projects in the segments of landfill, power efficiency, waste handling and disposal, among others are also being developed (Brazilian Ministry of Science and Technology, 2009).

It can be verified that the projects pertaining to the Energy Industries sectoral scope, and, more specifically, the ones searching for renewable energies, represent the majority of the CDM activities taking place in Brazil that are fostering the mitigation of global climate change. Thus, an effective contribution of these projects for the sustainable development and for the generation of clean technologies should be expected, and this is exactly what was evaluated by the present research.

Sachs (2002) emphasizes that sustainable development can be understood as the development that takes into consideration a socially receptive economic growth with methods favorable to the environment, and that conceals social, environmental and economic targets. Therefore, the CDM projects must demonstrate real, measurable and long-term advantages in the search of climate change solution, according to the criterion established by the Brazilian Designated National Authority (DNA)[3]. Another important concept in this study is the clean technology one, which aims to reduce in advance the emissions that are harmful for the environment, focusing on the causes of environmental degradation, not on its effects. So, the clean technologies are based on the prevention principle (Lenzi, 2006) and value the 3R's concept: reduction, reuse, and recycling (LaGrega, Buckingham & Evans, 1994).

Considering that the main target of this article is to evaluate the contribution of the Brazilian CDM projects of the Energy Industries sectoral scope in generating clean technologies on behalf of sustainable development, secondary data was collected from the

[3] For Brazil, this authority is the Inter-Ministry Commission for Global Climate Change whose presidency and vice-presidency belong, respectively, to the Ministry of Science and Technology and the Ministry of Environment.

Project Design Documents (PDDs) of the 37 projects listed in this category and that were approved by the CDM Project Executive Council in Brazil, and that were granted the carbon credit certificate by the UNFCCC until December 31st 2007.

The documental analysis guidelines used in this paper is part of a research project sponsored by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)*, named *"A Utilização dos Projetos de Mecanismos de Desenvolvimento Limpo pelas Empresas Brasileiras"* with the participation of three Brazilian universities. So, this article tries to fulfill a gap that exists in Brazil concerning the academic studies that have as purpose evaluate the contribution of the CDM projects for the generation of clean technologies on behalf of the sustainable development in host countries. This article is structured in two parts besides this introduction and the final considerations. In the first part, the theoretical background is presented and in the second part, the results found during the analysis of the studied CDM projects are discussed.

2. THEORETICAL BACKGROUND

In the 2006-2007 year period, the threat of the environmental disaster danger caused by human beings was unequivocally confirmed through the recognition of the IPCC's Fourth Report which assures that the global climate change are resultants of human-induced activities. Likewise, both the report about the economic consequences of the global warming, published in 2006 by Nicholas Stern, former World Bank Chief Economist, and the debates about the same subject in the Davos Economic Forum contributed to the main world leaders' recognition of the problem's urgency. This was a new fact, since, by this time, the declarations were not only made by environmentalists or scientists, but by economists and Heads of State, who until recently had treated the global environmental problems as a marginal issue.

This perception concerning the urgency of the global warming problem is being diffused among corporate actors. Then, some business actors have adopted the following environmental strategies: the internalization of the environmental negative externalities, the reduction of production cost, the optimization of natural resources, the minimization of waste generation, the green marketing of cleaner processes and products. So, the focus of environmental management goes beyond pollution control, it incorporates the concepts of

pollution prevention and cleaner production (Kiperstok, 2002). Considering the above mentioned facts, the companies have been noticing that the environmental issue cannot be considered as a barrier, but, instead, an opportunity for investment in process changes, in labor improvement, in raw material substitution, in the reduction of waste production, and in the rationalization of natural resources consumption, so gaining in terms of competitiveness and in terms of legitimacy by the society.

In this context, companies are becoming some of the principal social actors responsible for the implementation, from global to local level, of environmental multilateral agreements (Barbieri, 2004). The main motivational factor for the companies to change their previous perception is the search of their business' sustainability. In this aspect, the expression "sustainability" is based upon Sachs' (1993) approach, which identifies the existence of five sustainability dimensions (social, economic, ecological, spatial and cultural) that should be taken into account by any corporate environmental management.

The preoccupation about the environmental management has created a differentiated dynamics in the organizations and nations' local spaces. Such fact shows, therefore, a reflex of the social, political, and economic contexts of each country. Kitamura *apud* Carrieri (2001) argues that in the central countries, the sustainable development is configured as a proposal for quality of life and environmental protection improvements. But in peripheral countries, where basic problems such as food security still persist, sustainable development comes up as a broaden proposal, basically oriented to the solution of social welfare problems.

Alternatives for the countries' development, in a sustainable way, are being globally recommended by the United Nations. It is also true that, both the sustainable development and sustainability concepts were not forgotten during the writing of the Kyoto Protocol. Indeed, the treaty specifies that all member nations and, consequently, the industrial segments related to them, must try, as much as they can, to create new ways to carry out their production activities, minimizing the environmental impacts and guaranteeing the reduction of GHG. Also, according to the Protocol, they should give priority to the environmentally sound technologies transfer among the countries. Notwithstanding, this article questions the sufficiency and efficiency of the environmentally sound technology transfer notion in fostering sustainable development in CDM host countries projects, as it can be seen as follows.

2.1. ON THE TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGIES FOR THE DEVELOPMENT OF CLEAN TECHNOLOGIES: A NECESSARY TRANSITION

By analyzing the article 10 of the Kyoto Protocol, it is possible to observe that the technology is intrinsically related to the issue of sustainable development:

> The parties should cooperate in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector, to promote and enhance the transfer of, and access to, environmentally sound technologies (Senado Federal, 2004: 27).

Although the Protocol does not make clear the definition of environmentally sound technologies, and to better understand how the technology transfer may help the parties to achieve the sustainable development, it is important to define technology transfer in this context. According to Seres (2008:2-3), IPCC defines technology transfer as:

> a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGO's) and research/education institutions.

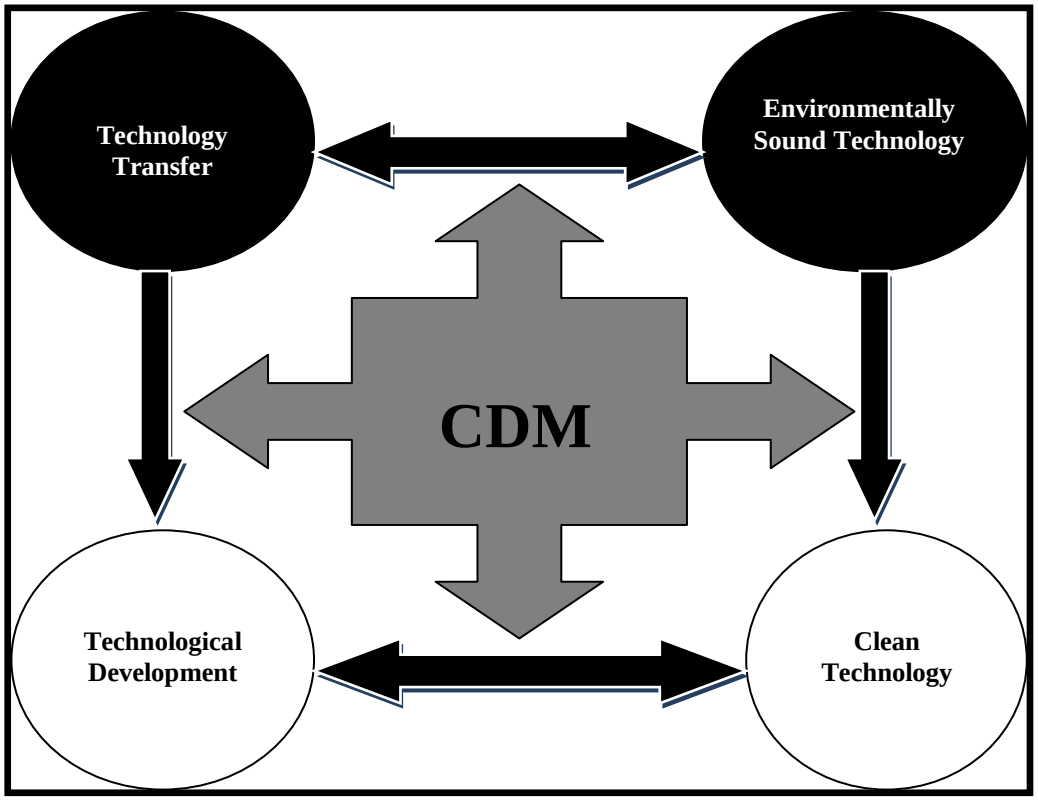
So, the technology transfer issue, that has so long been discussed in the global environmental agenda, and that plays an important role in the North-South ecopolitics, usually brings to it the notion of knowledge cession of the mainly developed countries (Northern countries) to the less developed ones (Southern countries). It is believed that countries with knowledge and domain in environmentally sound technologies should transfer them to countries with little or none installed technologic capacity, aiming to diminish the North-South knowledge and technologic capacity existing gap (Esty & Ivanova, 2002; Le Prestre, 2005).

However, this concept does not consider the existing asymmetries among Southern countries regarding the technologic development and qualification, neglecting that these resources differ tremendously among them. So, when putting the Brazilian reality in

perspective – it can be seen that, in certain areas, a consolidated technologic capacity already exists (the renewable energy segments, biofuel, deep water oil exploration, etc.). Thus, the environmentally sound technology transfer, notion present in the CDM projects, loses its meaning and may end up favoring the prior model in which Northern countries export outdated and obsolete environmental technologies to the Southern countries. An example of this is the end-of-pipe technology. Although, end-of-pipe technology is considered to be environmentally sound, its focus is on pollution control and not on the prevention and on the eco-efficiency of the natural resources. For this reason, it contributes very little to the sustainable development of CDM host countries.

Thus, countries like Brazil would be capable of influencing the extension of this kind of technology transfer. It would be possible to count on the CDM projects as a real tool in generating clean technologies based on the pollution prevention, eco-efficiency principles and technological innovation rather than on basic environmentally sound technologies whose focus relies mainly on the pollution control at the end-of-pipe. It can be seen in the conceptual framework proposed by this article (Figure 01):

Figure 01 - Conceptual Framework



Source: Self Elaboration

This argument is supported by Seres (2008) that points out that Brazil, China, India and South Korea – sharing 72% of the CDM projects that representing 80% of the annual emission reductions - can influence the extent of technology transfer involved in their CDM projects. Then, considering that the CDM may become a key tool in the promotion of the conception and use of clean technologies in behalf of the sustainable development, especially when dealing with the non-Annex I countries, it is necessary to better understand the concept of clean technologies.

2.2. ON THE END-OF-PIPE ENVIRONMENTALLY SOUND TECHNOLOGY TO CLEAN TECHNOLOGY: A NECESSARY CHANGE IN FAVOR OF THE SUSTAINABLE DEVELOPMENT

The environmental technologies may be divided in end-of-pipe pollution control technologies and clean technologies. The first one does not change the production system as it is, but introduces additional technological systems that capture pollutant emissions in order to minimize their environmental impacts. Clean technologies, on the other hand, do not try to treat the pollution after the emission, but to avoid or reduce such emission in advance. Its focus is on the environmental degradation causes, and not on its effects. Clean technologies are based on the prevention principle, in contrast to the end-of-pipe technologies, that are based on the reaction principle (Lenzi, 2006).

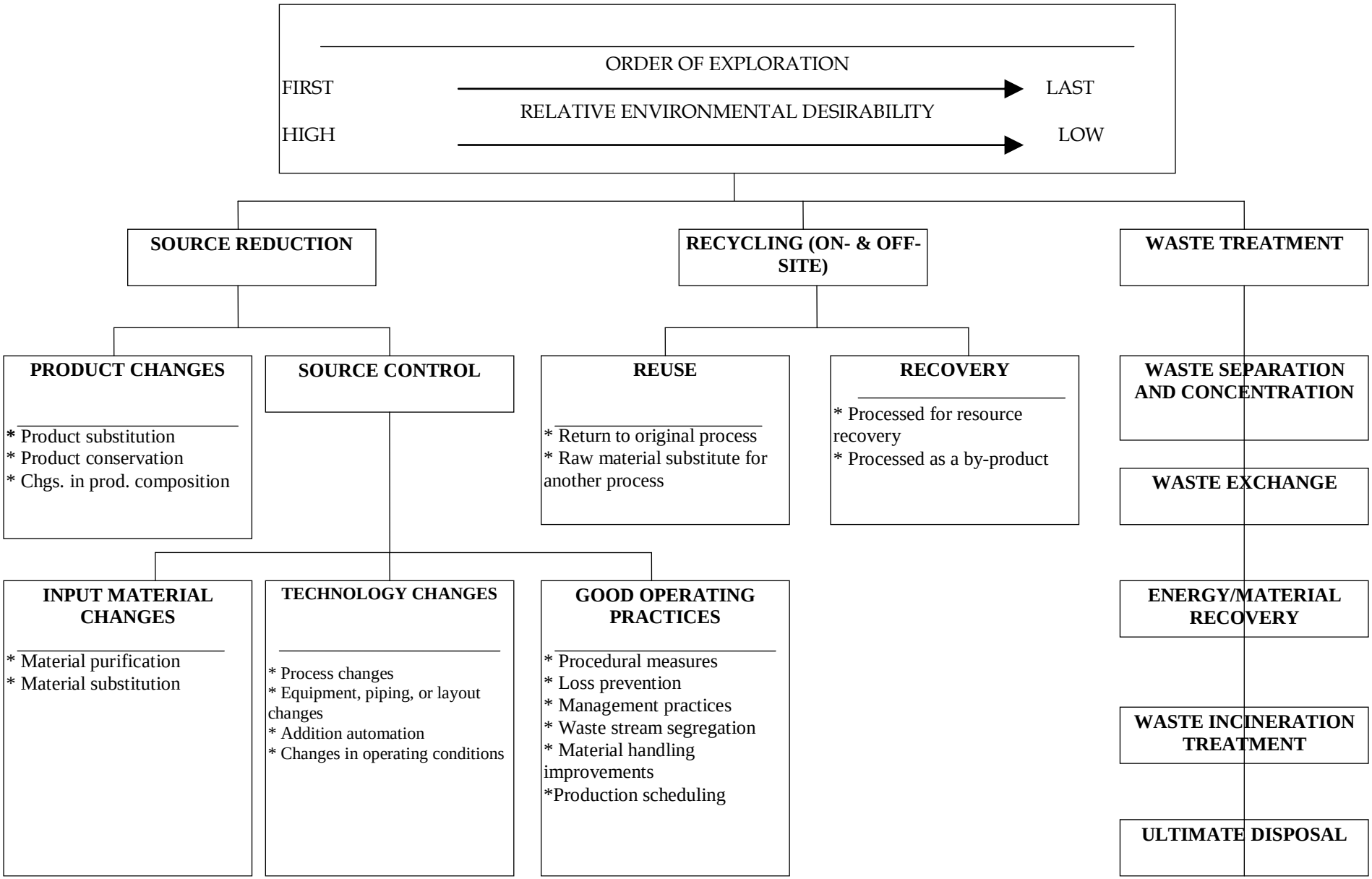
According to the World Business Council for Sustainable Development (2008), the use of clean technologies can be understood as a continuous application of a technical, economic, and environmental strategy integrated to the processes, products and services, in order to raise the efficiency in the use of raw materials, water, and energy, for the non-generation, minimizing or recycling of residues and emissions, with environmental, occupational and economic benefits. Thus, clean technologies are characterized by the adoption of any change measure or transformation methods that are used to reduce or to eliminate any kind of pollution, and at the same time, to rationalize the use of natural or non-natural resources. By this way, the 3R's concept is valued: reduction, reuse, and recycling.

According to LaGrega *et al*. (1994) the arrangement of the 3R's above mentioned does not occur in a random way. This idea can be better understood in Figure 02. It shows the

different types of environmental strategies that an organization can adopt to reduce pollution. The more focused to the right side of the board the technologies and practices are, the more to end-of-pipe they will be. On the other hand, the more focused on the left side, more highly oriented to source reduction and clean production the process will be. This way, when the companies try to reduce residues at the source, they change their own production processes by eliminating the wastes and reducing not only the environmental impacts, but also the production costs as well. Therefore, the repetition of this innovative strategy would lead to a higher use of clean technologies, characterizing a situation of double dividend, where the companies would be more competitive, and the whole society would benefit with the reduction of the environmental impacts (Kiperstok, 2003).

Indeed, the generation of clean technologies can only be characterized if the pollution prevention aspect is contemplated. According to Batista (1993), before new and better environmental technologies become a constant in the market, it is necessary to go through a period of transition from the old "end-of-pipe" technological model, even if it is still considered environmentally sound, to a new model based on "clean technologies" on behalf of sustainable development.

Figure 02 - Pollutant Reduction Techniques



Source: LaGrega et al.,1994

3. ANALYSES AND RESULTS

The results presented here reflect the analysis of the 37 Brazilian projects in Energy Industries sectoral scope that, in December 2007, had already been granted with the Certified Emission Reductions (CERs) by the UNFCCC. This sectoral scope, besides being the one that mostly attracts the attention of the Brazilian corporate segment (the renewable energy represents 50% of CDM Brazilian projects), carries within itself a special importance: the energy matrix worldly adopted, strongly based on non-renewable sources, like oil and coal, is considered to be the main responsible for the global warming. Initially, a short characterization of the analyzed projects is presented.

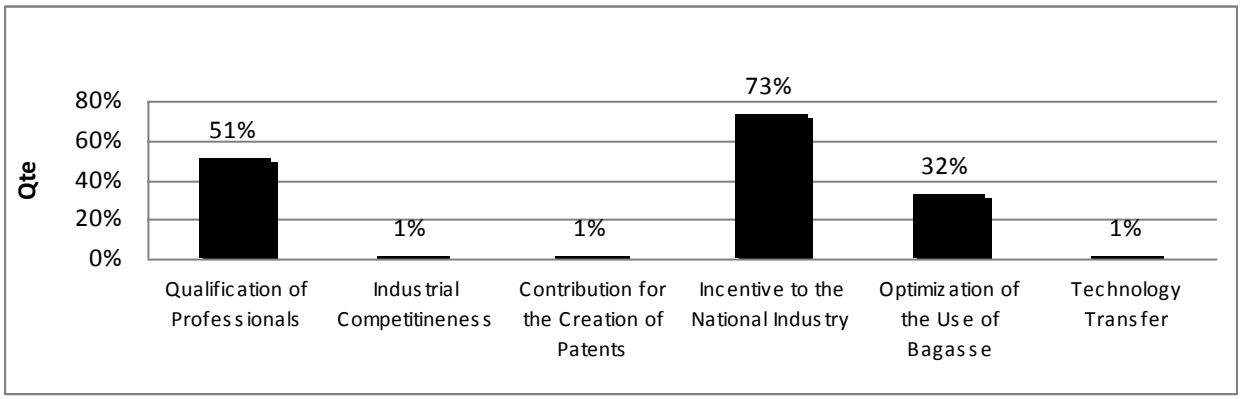
It can be verified that 76% of the CDM Brazilian projects of this sectoral scope were developed in the Southeastern region, 60% exclusively in São Paulo state. They are strongly focused on methodologies related to the cogeneration of energy by sugar-cane bagasse (65%) and on energy generation by natural gas (24.5%). It is important to mention that 94% of the projects analyzed were done with the support of Ecoenergy (51%), Ecoinvest (30%) and Ecosecurities (13%). This research ratifies Motta and Guimarães' (2008) verification that the carbon market is headed by the European Union, whose member countries were responsible by the purchase of 84% of the credits generated by the projects analyzed, with a special mention to the United Kingdom (35%) and Switzerland (24%). However, the participation of Japan and New Zealand should not be ignored, each one being responsible for the purchase of 13.5% of the credits generated by the analyzed projects.

Now, the three most important topics of this research are analyzed: Technology Transfer, Clean Technology and Sustainable Development.

3.1. TECHNOLOGY TRANSFER

It was verified that, concerning the benefits of technology, the main aspects are related to the national industry incentive, professional qualification and the optimization of the use of sugar-cane bagasse, as it can be seen in Figure 03.

Figure 03 - Benefits in Technological Aspect



Source: Self Elaboration

Note: the sum of percentages in Figure 3 above is greater than 100% due to the fact that a benefit was reported by more than one project reviewed.

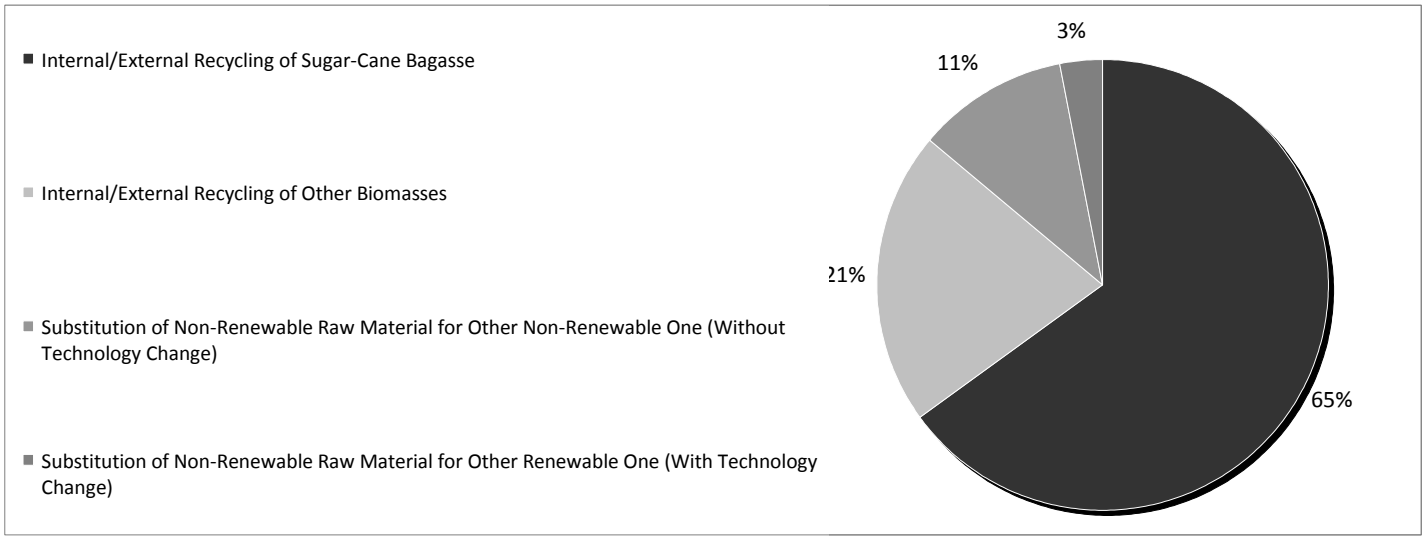
As shown in Figure 03, the "incentive to the national industry" was declared by 73% of the analyzed projects. It happens because the companies have purchased, in the national market, the necessary equipment to the CDM project implementation. This equipment purchase contributes with the Brazilian economy development, but it does not represent a relevant contribution in terms of technological development to the country. The majority of the equipment was already available for purchase in the national market. Consequently, the "qualification of professionals" aspect (51%) shows the need of qualification of the labor involved in the operation and maintenance of the equipments, what happens by means of previous-known knowledge transfer.

Concerning the benefit "optimization of the use of sugar-cane bagasse", it is important to highlight that this perspective presented in 32% of the projects analyzed are related to the "cogeneration of energy by sugar-cane bagasse". However, it can be observed that the items "technology transfer", "contribution for the creation of patents", and "industrial competitiveness" were mentioned by only 1% of the analyzed projects. These numerical figures show that the idea of technology transfer was not preponderant, because, as previously discussed, both the equipment and the know-how have already existed in Brazil. Consequently, there is an incipient contribution of the CDM analyzed projects for the creation of patents, generation of innovation and increase of industrial competitiveness.

3.2. CLEAN TECHNOLOGIES

According to the article 12 of Kyoto Protocol, the CDM projects should promote the sustainable development through the use of new and renewable forms of energy, as well as environmentally sound technologies. Following this premise, Figure 04 shows the pollutant reduction techniques utilized by the 37 analyzed projects of the Energy Industries:

Figure 04-Pollutant Reduction Techniques in the Energy Industries CDM Projects



Source: Self Elaboration

It is possible to infer that the majority of the analyzed projects (65%) transformed a residue from sugar and alcohol production (sugar-cane bagasse) in renewable raw-material for energy generation by internal/external recycling. However, it was verified that the principal Brazilian sugar-alcohol plants have already utilized this kind of cogeneration technology in order to be self-sufficient in energy. Therefore, CDM projects came up as a financial-economic opportunity for these companies, since, besides making the plants self-sufficient in energy, they diversify their activities via the sale of the energy surplus. This statement is supported by the fact that in all the 37 analyzed projects, the plant owners were emphatic in saying that if there was no pecuniary compensation for the CDM projects there would not be a motivation for implementing the mentioned environmental strategy. This occurs because the Brazilian energy matrix is

hydroelectric, i.e. renewable, accessible, and cheap. Still holding with the idea of internal/external recycling as pollutant reduction technique, around 21% of the analyzed projects have utilized others biomasses (wood, rice husk, etc.) for energy generation.

As seen in Figure 04, on 11% of the analyzed projects there was a substitution of raw-material, from fossil fuel to other one of same origin (natural gas). However, despite the fact that the raw material still be considered non-renewable, the implementation of these CDM projects of energy cogeneration by natural gas made possible the introduction of a raw-material less pollutant without major technological change.

Finally, only 3% of the analyzed projects covers the substitution of a non-renewable raw-material (fossil fuel) for other renewable one (biofuel). In these projects, there was a source reduction via technological change. Thus, despite the fact that the CDM makes possible the creation of technologies considered environmentally sound, only 3% of the analyzed projects are characterized by a real application of technology focused on cleaner production.

3.3. SUSTAINABLE DEVELOPMENT

Taking into consideration the main dimensions of sustainable development (economic, social and environmental), the Brazilian Designated National Authority (DNA) sets up five basic criterion to evaluate the CDM projects:

a) Contribution for the local environmental sustainability: it tries to evaluate the mitigation of the project local environmental impacts (solid residues, liquid effluents, atmospheric pollutants, among others) in comparison with “reference scenario”, i.e. the situation that exists in the absence of the project;
b) Contribution for the development of work conditions and net generation of job: it tries to verify the project’s commitment with social and labor responsibilities, health and educational programs, and civil rights defense. It also verifies the improvements, at qualitative and quantitative levels, on direct and indirect job positions in comparison to the “reference scenario”;
c) Contribution for wealth sharing: it analyzes the direct and indirect effects over the low-income population’s quality of life, observing the socio-economic benefits of the

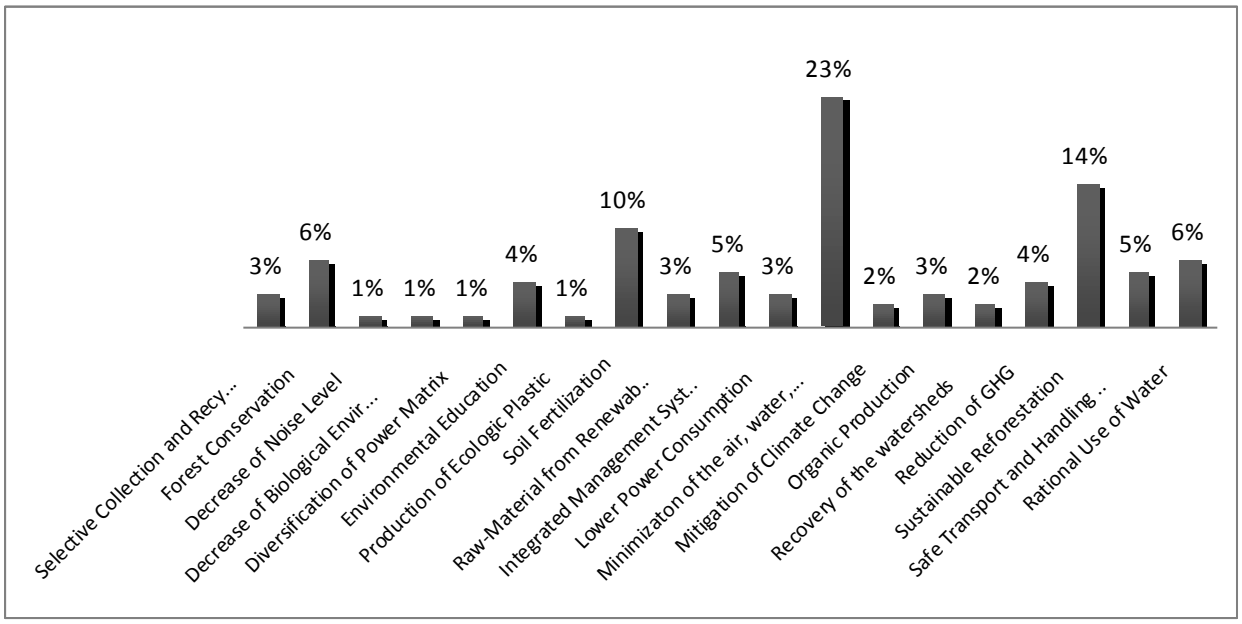
project;

d) Contribution for qualification and technological development: it evaluates the level of technological development of the project in relation to the "reference scenario". The possibility of technology transfer is also verified;

e) Contribution for regional integration and articulation with other economic sectors: it evaluates the integration of the project with other socio-economic activities in the region (*Comissão Interministerial sobre Mudança Global do Clima*, 2003).

Figures 05, 06 and 07 show the environmental, social and economic contributions of the 37 analyzed CDM projects in Brazil:

Figure 05 - Environmental Aspects



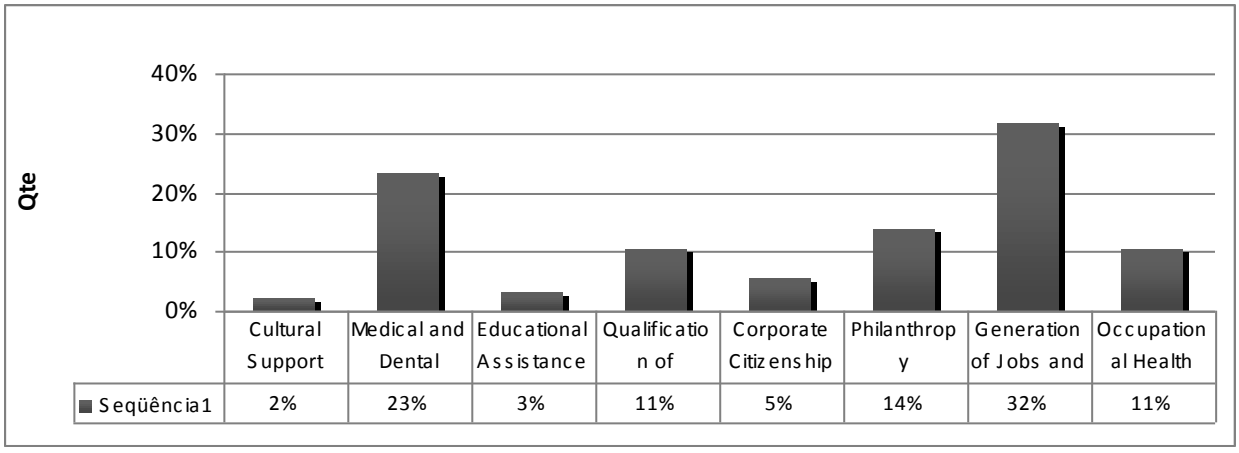
Source: Self Elaboration

The "minimization of air, water and soil pollution" is one of the main positive environmental aspects mentioned by 23% of the 37 analyzed CDM projects. On the other hand, "GHG reduction" and "minimization of climate change" were mentioned only 4% and 2%. These ones should be, at least theoretically, the main expected contributions of a CDM project. The fact that, in the first period of commitments of the Kyoto Protocol, the GHG reduction in the

developing countries is voluntary must be considered. Possibly, if the GHG reductions were mandatory in Brazil, these aspects would be mentioned by a remarkable amount of companies.
It can be observed that the other environmental aspects mentioned ("the sustainable reforestation" – 14%, "soil fertilization"- 10% and "forest conservation" – 6%) are not directly related to the activities developed in the CDM projects. The analyzed PPDs make clear that these activities were not developed by the CDM projects, but they are part of the company's environmental management systems. Another aspect to be observed is the incipient CDM projects' contribution to the eco-efficiency of the proponent companies. The "lower power consumption" and "rational use of water" were mentioned only by 3% and 6% of the 37 analyzed projects.

Figure 06 shows the social contribution of the 37 analyzed CDM projects in Brazil:

Figure 06 - Social Aspects



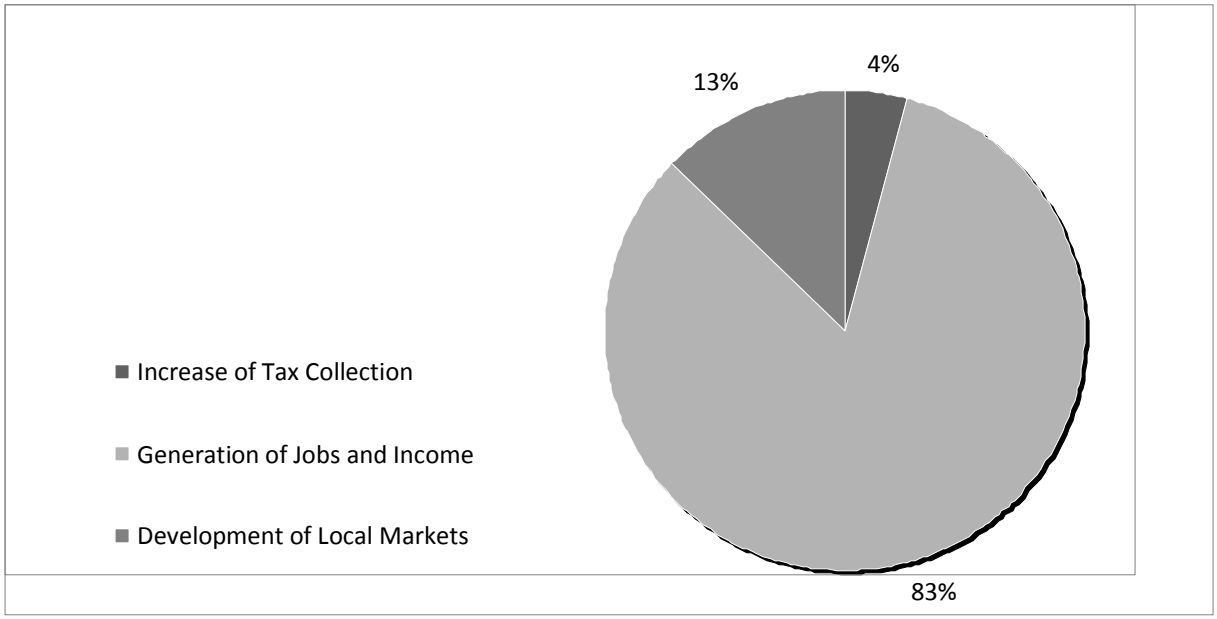
Source: Self Elaboration

Among the positive impacts mentioned in Figure 06, the reference made to "new job placement generation" (32 %) is highlighted. However, it is important to mention that some of the analyzed companies make clear that the most of job placements created by CDM project do not request high professional qualifications. This result can be related mainly to the low qualification labor force in the sugar-cane bagasse cogeneration projects. The second mostly mentioned aspect was "medical and dental assistance" offered to the workers (23%). It is a benefit that, despite having being already incorporated to the Labor Collective Agreement of many categories, is still poorly offered to the workers of Brazilian sugar-alcohol industry.

Other item that should be emphasized is the fact that "philanthropy" was mentioned by 14% of the projects as one of the main positive social impacts. It is the third mostly mentioned aspect. Actions of "corporate citizenship" (5%) and "cultural support" (2%) were also mentioned. One of the aspects mostly related to a possible contribution of the CDM project for the sustainable development of the region where it is installed is the "qualification of the professionals" involved. This item was mentioned only by 11% of the projects. It is related to the qualitative improvements of the jobs involved in the CDM project, along with the "educational assistance" (3%).

Figure 07 shows the economic contribution of the 37 analyzed CDM projects in Brazil:

Figure 07 - Economic Aspects



Source: Self Elaboration

Eighty three per cent (83%) of the projects declare the "generation of jobs and income" for the community as the most important economic aspect. Once more, it is necessary to question which phase of the projects these jobs are generated in and which is the level of complexity of the requested activities. The "development of local markets", which could be a good economic indicator of sustainable development, comes in second place, with only 13%. The "increase of tax

collection", which could be related to item "c" of the sustainable development requests stipulated by Brazilian DNA, was mentioned only by 4% of the analyzed projects.

4. FINAL CONSIDERATIONS

The present article shows the results of an academic research that intends to analyze the Brazilian CDM projects' contributions for the clean technology generation and the sustainable development. It evaluates the 37 Brazilian CDM projects related to the Energy Industries and that had received carbon credits up to 2007.

Despite the fact that the Kyoto Protocol establishes the cooperation among the countries participants of the CDM projects as mandatory, by means of the "environmentally sound technology transfer" on behalf of the sustainable development, this article defends that it is necessary for the CDM projects to contribute to the development of clean technology. It argues that is not efficient to promote clean development only through an "environmentally sound technology transfer" strategy. Generally, this environmental strategy concentrates on the pollution control and not on clean production. Thus, the necessity of cooperation/partnership between the countries participants of CDM projects to enhance the qualification and technological development based on innovation and clean production is discussed.

After analyzing the 37 Brazilian CDM projects related to the Energy Industries, it can be affirmed that the contribution of these projects for the development of clean technology is incipient: only 3% of the projects analyzed could be characterized by the real application of a technology focused on cleaner production. Thus, considering that the clean technology is the most adequate one to reach a sustainable and cleaner development, it is not possible to affirm that these Brazilian CDM projects are effectively contributing for this target. It can be verified that the analyzed projects partly meet only 2 (two) of the 5 (five) criteria stipulated by Brazilian DNA to evaluate the CDM contribution for the sustainable development: items "a" (local environmental sustainability) and "b" (development of work conditions). No effective contribution for income sharing (item "c") or technological innovations (item "d") were observed. No contributions for the regional integration or articulation with other production sectors in the regions where the projects were applied (item "e") were verified.

So, the analysis of the Brazilian projects related to the Energy Industries reveal that, at least in Brazil, CDM is far from achieving the fundamental purpose of minimizing the global warming via the stimulation of a cleaner development model relied on the cooperation among countries.

Finally, it is recommended that further and more comprehensive researches about the Brazilian CDM projects' reality are made, as well as a comparison with the two other most important host countries (India and China) in order to verify the real contribution of this kind of project to the generation of clean technologies and the promotion of sustainable development.

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