MITIGATING CLIMATE CHANGE IN BRAZIL: CLEAN DEVELOPMENT MECHANISM AND EMISSIONS TRADING

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DECLARATION

I declare that the dissertation entitled "**Mitigating Climate Change in Brazil: Clean Development Mechanism and Emissions Trading**" submitted by me in partial fulfilment of the requirements for the award of the degree of **MASTER OF PHILOSOPHY** of Jawaharlal Nehru University is my own work. The dissertation has not been submitted for any other degree of this University or any other university.

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CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation.

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ABBREVIATIONS

CO2	Carbon Dioxide
IPCC	Intergovernmental Panel on Climate Change
CCST	Earth System Science Centre
INPE	Brazilian National Institute for Space Research
WCED	World Commission on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
NAM	Non-Aligned Movement
GHG	Green House Gases
CDM	Clean Development Mechanism
JI	Joint Implementation
AAU	Assigned Amounts Unit
RMU	Removal Unit
ERU	Emission Reduction Unit
CER	Certified Emission Reduction
MCT	*Ministério de Ciência e Tecnologia* /Ministry of Science and Technology
WCED	World Commission on Environment and Development
LULUCF	Land Use, Land Use Change and Forestry
N2O	Nitrous Oxide
GWP	Global Warming Potential
CIMGC	Interministerial Commission on Climate Change

BNDES	Brazilian National Development Bank
ETS	Emissions Trading Schemes
CH4	Methane
H2SO4	Sulphuric Acid
HFC-23	Hydroflourocarbon-23
UNDP	United Nations Development Programme
COP	Conference of Parties
DOE	Designated Operational Entity
DNA	Designated National Entity
CDM-EB	Clean Development Mechanism- Executive Board
SIDS	Small Island Developing States
REDD	Reducing Emissions from Deforestation and Forest Degradation
MAC	Marginal Abatement Curve
CIMGC	*Comissão Interministerial para a Mudança Global do Clima*/ Interministerial Commission on Global Climate Change
MMA	*Ministério do Meio Ambiente* /Ministry of Environment
MRE	*Ministério das Relações Exteriores*/ Ministry of Foreign Affairs
CIDES	Interministerial Commission for Sustainable Development
TNSG	Transnational Networks of Sub-National Governments
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources
PPM	Parts Per Million

NAM	Non Aligned Summit
CDF	Clean Development Fund
PROINFA	Programme of Incentives for Alternate Electricity Sources
UNCED	United Nations Conference on Environment and Development
EU ETS	European Union Emissions Trading Scheme
VER	Verified Emissions Reductions

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Preface

The contemporary understanding of climate change is encapsulated in an inter-disciplinary concept that acknowledges the many dimensions to this phenomenon. Climate change is not only an environmental challenge but also an economic and developmental one. Therefore, a successful mitigation strategy needs to have the capacity to deal with the threats posed by climate change in a sustainable way that doesn't encroach upon the growth and developmental needs of less developed nations. The Kyoto Protocol was introduced as a holistic approach to a complex problem in view of the difficulty of enforcing a globally binding climate change mitigation programme that would be fair to all parties. The Kyoto Protocol contains three potent mitigation tools which are also known as 'flexible mechanisms' because, firstly, they provide countries with an alternate route to reducing emissions and, secondly, they come equipped with an in-built adaptability that gives them the flexibility to be customized to fulfil each country's special needs. Another innovation of the Kyoto Protocol is that it acknowledged and incorporated a mechanism to meet the sustainability and developmental priorities of developing and emerging economies. This mechanism is known as the *Clean Development Mechanism* (CDM) and its market oriented counterpart is known as *emissions trading*. CDM and emissions trading projects are important climate policy tools because they help developing countries adopt a low-carbon growth trajectory (in theory, at least) and also increase their capacity to make the required structural adjustments in their economies to sustain low-carbon growth.

The flexible mechanisms are particularly intriguing in Brazil's case as it is an emerging economy that has the archetypal mitigation and investment opportunities for the CDM on the one hand; and on the other hand, it has the kind of development dilemmas which are typically associated with developing nations. Therefore, the flexible mechanisms are an ideal means for Brazil to show the international community that it is serious about climate change mitigation, while also not betraying its national development agenda.

This dissertation studies whether adopting CDM and emissions trading in Brazil has helped in mitigating the effects of climate change in a nationally appropriate and cost effective way.

Another aspect that has been delved into is whether adopting these mechanisms has resulted in additional linked benefits in Brazil—such as the strengthening of domestic institutional structures for climate governance, the benefits to local communities around project areas, the preservation of forest resources and an improvement in sustainable development indicators. The sustainability approach has been adopted for studying these linked benefits.

Finally, this dissertation argues that CDM and emissions trading have helped Brazil in capacity building, introducing best practices, compelling the development of institutions and governance mechanisms and have therefore, enhanced Brazil's ability to carry out mitigation activities. In fact, it is proposed that the success of the two flexible mechanisms can be attributed to the reciprocal institution-building and complementary regulatory and governance mechanisms of both Brazil and Kyoto Protocol itself. Thus, the three hypotheses (with the first hypothesis being framed as two complementary propositions) that have been proposed are:

Hypothesis 1a: Brazil's participation in the CDM has been enhanced by its institutional and regulatory environment.

Hypothesis 1b: Brazil's success in achieving its mitigation and sustainability goals is due to the CDM's assistance in institutional capacity building in Brazil.

Hypothesis 2: CDM has fostered investment in previously under-represented energy sectors by encouraging financial and technological transfers.

Hypothesis 3: Brazil's participation in the carbon market has included the participation of primary stakeholders and has thus, increased forestry conservation activities.

CHAPTER I

Conceptualizing Climate Change in Brazil

Introduction

Climate change is not a malaise that originated with the excesses of the twentieth century. In 1859, a hundred and fifty years before the release of Al Gore's "An Inconvenient Truth," a documentary credited with educating the masses about global warming, John Tyndall discovered that the effect of certain gases in the atmosphere could cause climate change. In fact in 1896, in the throes of western industrialization, the scientist Svante Arrhenius tried to draw attention to the rising incidence of global warming caused by carbon dioxide (CO2) emissions from human activities (Arrhenius 1896).[1] These findings were fragmented over time and the project of industrialization continued, fuelled by the easy availability of fossil fuels and the belief in their inexhaustible supply. Over the next few decades other scientists, research organizations and government funded programmes voiced their concern that measurable temperature increases supported the hypothesis that climate change was real and a result of the rising concentration of greenhouse gases (GHG) in the atmosphere. [2] These gases, which included CO2, caused the warming of the earth and its atmosphere by trapping in infrared radiation from the surface of the earth (World Meteorological Organization 1990). Of these gases, carbon dioxide was found to account for a massive 77% of global warming potential; therefore, global climate change mitigation efforts called for the

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[1] In Arrhenius' 1896 paper, 'On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground' he tried to quantify the contribution of carbonic acid to the greenhouse effect and was the first to do so. At the time carbon dioxide was referred to as carbonic acid.

2 In 1945, the United States Office of Naval Research conducted research on climate change. In 1967 Syukuro Manabe, a Japanese meteorologist and climatologist, and Richard Wetherald showed how doubling the atmospheric concentrations of CO2 could increase global temperatures. Manabe collaborated with many other scientists to publish a series of papers on the earth's sensitivity to greenhouse gases which influenced some of the work of the Intergovernmental Panel on Climate Change.

imposition of CO2-sourced emission limits or quotas. The science behind the CO2 quotas is also supported by other research work which shows that by halving CO2 by 2050 compared to 1990 levels, global warming can be stabilized (Meinshausen et al. 2009).[3] These findings formed the basis of the decision to focus on carbon emissions reductions in the Kyoto Protocol. In its influential fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC), an intergovernmental body that assesses climate change, asserted that the 'globally averaged net effect of human activities since 1750 has been one of warming' (IPCC 2007). Thus, it was proven that the present manifestation of global climate change was the result of unchecked cumulative environmental damage because of carbon and other GHG emissions.

Climate Change Threats and Risks

Climate change is seen as a threat because of the indiscriminate and irreversible impact it has on humans, socio-economic systems, the natural environment, the weather and the ecological balance. In 2007 an IPCC report asserted with 'very high confidence' that more than 2 degrees increase in global temperatures over the pre-industrial era (1850s) could lead to catastrophic results. Carbon dioxide levels of 450 ppm (parts per million) or CO2 equivalents in the atmosphere indicates a danger signal as it leads to 2 degrees increase in temperature (Banuri and Opschoor 2007). What is alarming is that the current level of atmospheric CO2 has already touched 430 ppm.

Climate change falls in a special category of risk termed as 'manufactured risk' by Giddens (2009). Manufactured risk is based on the growing corpus of knowledge about climate change which informs our evaluation of possible outcomes of a situation. This does not mean that dire risk assessments are needlessly alarmist or illusory—what it means is that with greater access to information and new analyses the risk assessment for climate change now covers a wider pool of actors and has thus widened our perceptions and understanding about it. Risks to the environment have also brought into focus the allied problems of inequality, justice and economic allocation. Human habitats are at risk of destruction with the irony being that those who are the least responsible for climate change are the ones most

[3] The reason for the greater role CO2 plays in warming is its ubiquity in emissions and the fact that it is a long lived gas and its atmospheric effects are felt longer.

impacted by it and also the ones least able to cope with it (Smit et al. 2001). This is because the poor are restricted by their limited means to swiftly adapt to changes in the climate (Agerup et al. 2004). Some view the risk and accompanying vulnerability of the poor as a socially constructed result of their being denied a fair share of resources to adapt to climate change (Blaikie 1995).

However, global warming is expected to reach a secularizing 'tipping point' when all nations, regardless of their share of responsibility or development, will be equally exposed to global warming risks. In the first wave climate change serves to sharpen the cleavages between the poor and the rich and in the second wave it is expected to be an all encompassing force without distinction in its devastating effect on all members of the human race. This is what Beck (2010) refers to as the 'hierarchical' and 'democratic' nature of climate change. There is also a distinction between climate *risks* and climate *catastrophes* (Beck 2010). Generally speaking, there is an uneven distribution of risk throughout different countries and regions with the poor being the most at climate risk and a climate catastrophe being an event that affects a vast sweep of population.

Low lying coastal environs and their populations are particularly vulnerable to the effects of climate change and it is feared that the Maldives will become completely submerged. Along with the Maldives, the Sahel region of Africa will be the most impacted by climate change. The Intergovernmental Panel on Climate Change's (IPCC) projections for Latin America range from a loss of biodiversity to the replacement of tropical forests by savannah vegetation in eastern Amazonia which lies in Brazil (IPCC 2007). Brazil is expected to witness a fall in agricultural and livestock productivity and changes in precipitation patterns may affect the availability of water for human consumption. [4]

The Importance of Climate Change Mitigation for Brazil

The disconnect between abstract rhetoric and concrete policies will continue as long as climate change is measurable only in scientific, mathematical terms and not actually

[4] IPCC Fourth Assessment Report details the probable effects of global warming in Latin America with a level of high confidence. The predictions made by the IPCC are labelled with three levels of certainty that the event will come to pass: medium confidence, high confidence and very high confidence.

experienced as a ground reality. The twenty first century changed the perception of Brazilian policymakers that climate change is a subject to be skilfully debated about only in the negotiating tables of international conferences (Rohter 2007). The last ten years has brought aberrant weather associated with climate change to Brazil and it recorded volatile climatic conditions in a short span of time. Hurricanes in southern Brazil were an alien weather phenomenon and yet they became a destructive reality when hurricane Catarina hit Brazil in 2004 (Marengo 2008). It was the first recorded hurricane in the South Atlantic.

Another sensitive pressure point for Brazil in terms of climate vulnerability is the Amazonian region which is a hub for biodiversity and has been particularly sensitive to the effects of climate change. There have been fears that damage to the Amazon system may be irreversible, triggering a domino effect of the successive collapse of ecosystems if efforts at conservation and mitigation are not stepped up. This is referred to as the tipping point for climate change (Marengo et al. 2011). Organizations like the Earth System Science Center (CCST) of the Brazilian National Institute for Space Research (INPE) have simulated a model depicting climate change in Brazil which specifically shows the effects of climate change in Brazil for varying levels of global warming. The model shows a greater average increase in temperatures in the Amazon region as compared to the rest of the world, a condition which is projected to worsen after 2040 (Marengo et al. 2011). Recorded changes already show an increased incidence of flooding (2009) and droughts (2005 and 2010) in the Amazonia (CCST and INPE 2011). The importance of the Amazon for Brazil is due to its preventive and regulatory role in maintaining the climate system in the country through carbon storage and energy and water source regulation (Soares-Filho et al. 2009). Other than changes through the direct emissions of carbon, land use changes like deforestation for population settlements, agriculture and so on also affect the health of the Amazons and its ecosystem (Fearnside 2001; Malhi et al. 2008). The destruction of the Amazon also contributes to carbon pollution in the atmosphere, with deforestation being the biggest contributor to Brazil's carbon dioxide emissions (Soares-Filho et al. 2009)[5]. For instance, the burning of biomass for fuel or for the purpose of clearing forests produces large amounts

[5] In the earlier draft of the Kyoto Protocol it was acknowledged that the degradation of forest resources and deforestation resulted in rising levels of GHG emissions. However, due to the resistance of countries like Brazil, deforestation was later left out.

of greenhouse gases. Indigenous populations are also affected by displacement and the loss of livelihoods. Traditionally, international involvement in the Amazon region of Brazil had always aroused fears that its sovereign rights would be violated (Cole and Liverman, 2011). However, there is a recent acceptance that climate change has palpable and disastrous consequences for Brazil which has made the Brazilian government finally include deforestation as a negotiable topic in climate diplomacy.

In testimony to the multi-dimensional effects of climate change, Brazil's developmental, socio-economic and infrastructural needs are also at threat because of global warming. This is because projections made about the implications of climate change for Brazil also include reduced rainfall which can severely impact Brazil's dependence on hydroelectricity for its energy needs in the future (Marengo 2004). Also, climate change has a tendency to reinforce socio-economic inequalities and exacerbate the condition of populations-at-risk (Adger et al. 2003). Brazil's northeast, home to about two million small farmers, is also the most at risk from climate change. This region already experiences a water deficit and extremes of temperature—two fatal factors for agricultural productivity and those whose livelihoods depend on it—which will worsen poverty in this region in the absence of mitigation and adaptive strategies (Obermaier et al. 2009).

Mitigation versus Adaptation: Understanding the Emphasis on Mitigation of Climate Change

The emphasis of climate treaties is on climate change mitigation rather than adaptation as is the focus of this dissertation. Conceptually, adaptation seems a rather logical course of action for coping with climate change but operationally it is found to be inadequate as the primary response. While mitigation and adaptation to climate change are two concepts which are linked in climate discourse (Kyoto 1997), there are significant differences in the approach, temporality and costs of both. Adaptation is defined as 'the adjustment of a system to moderate the impacts of climate change, to take advantages of new opportunities or to cope with the consequences' (Adger et al. 2003: 15). The COP-7 in 2001 at Marrakesh addressed both adaptation and mitigation to climate change while acknowledging the problems with adaptation faced by developing nations (Adger, Huq et al. 2003). While people of the developing world have been resiliently adaptive in the face of natural catastrophes like floods, hurricanes and drought considering the scale and permanence of climate change, the time span for adaptation to climate change may not be enough[6]. Smit et al. (2001) divided adaptation into two categories—planned adaptation (like public policy) undertaken by governments on behalf of their citizens; and autonomous adaptation (like migration) undertaken by individuals in case of extreme events. Some planned adaptation is necessary because of the inevitability of the future impact of climate change considering scale required for adaptive mechanisms and the belated response to it (Adger 2001). Brazil's semi-arid Northeast is particularly vulnerable to the effects of climate change and is urgently in need of intervention in the form of planned adaptation. However, in the absence of adequate funds and state supported capacity building initiatives, adaptation efforts have been thwarted (Obermaier et al. 2009). [7] These failed attempts at adaptation underline the requirement of a minimum threshold of institutional and economic inputs without which effective and organized adaptation is expensive and difficult. For instance, Brazil has instituted such adaptation mechanisms like early warning systems in its coastal areas and environmental risk management programmes but these aren't uniformly distributed over the nation. Adaptation is also gaining importance in Brazilian governance by featuring in the National Climate Change Policy Plan (Governo Federal 2008)[8]. However, adaptation programmes are not effective in the absence of political, technological and institutional support, capacity building or informational systems (IPCC 2007). Adaptation isn't the most prudent response when aberrant weather patterns, including the cold wave in Brazil in 1975 which devastated its coffee crops, can mean that trying to adapt to the destruction of climate change can be expensive or impossible. Due to the asymmetrical impact of climate change in the world the costs of adaptation are also skewed, heavily tilted against poorer countries (Adger 2001). Thus, with a developing nation like Brazil which hasn't set into motion

[6] This adaptation can be in the form of migration, alternate livelihoods, enhanced production, improved technology and so on. Autonomous adaptation would fall under 'Collective Action', a concept elaborated by Agrawal (2001) which is defined by group size, group homogeneity, boundaries of common resource pools and so on which will all determine adaptive success.

[7] There was a pilot project on synthesizing adaptation strategies with poverty removal in the Northeastern municipality of Pintadas in 2006. There is now a joint Brazil and Germany effort to take the best practices from this project and replicate this and similar other successes (Obermaier et al. 2009).

[8] Source quoted in Obermaier et al. 2009:5.

many adaptation strategies and is characterized by inequality, adaptation isn't a strategy that can be given pre-eminence.

The definitive guide to mitigation, the Stern Review (Stern 2006), views mitigation as an investment that entails early and definitive action to reduce emissions to avoid severe consequences in the future. There are lower carbon reduction costs associated with mitigation than with adaptation and the costs of future adaptation far outweigh those of mitigation action in the present (Stern Review 2006; Serroa da Motta et al. 2000). Stern arrives at this conclusion by comparing three scenarios: weighing the impacts of unmitigated climate change on human life and the environment with the cost of developing and adopting clean technology; comparing estimates of economic impacts of climate change with costs for switching to a low carbon model; and comparing future and current social cost of carbon with the marginal abatement costs. Developing nations have insisted on linking sustainable development with climate control or mitigation strategies. Also, purely in terms of costs to an economy, mitigation activities taken on in the developed world will be less expensive because developmental goals aren't affected; from the perspective of developing countries it's a matter of annex I countries eschewing certain luxuries. O'Neill and Oppenheimer (2002) believe that while Kyoto provides only marginal reductions in emissions which can't reverse the effects of climate change, it is the essential first step in mitigation to prevent a 'dangerous interference.' Their projections show that by delaying mitigation plans by 10 years, the costs of global reductions become prohibitive. Since mitigation requires lessening the energy intensity used as well as the carbon intensity of energy resources, it is a strategy well suited for Brazil from the perspective of its energy use.[9]

[9] The costs of mitigation increase (with a goal of not exceeding 450 ppm of carbon dioxide) depending on the level of terrestrial absorption of GHGs. If the capacity for terrestrial uptake (for instance, using forests as carbon sinks which can help neutralize the effect of carbon dioxide) is lowered then the global GHG reductions would have to be as high as 8% by 2040 (O'Neill and Oppenheimer 2002). A study by Hu (2010) shows that subalpine forests are losing their capacity to absorb CO2 with the warming of the climate (Science Daily 2010).

The Brazilian State's Response to Climate Change: Till the Kyoto Protocol

Cole and Silverman (2011) argued that Brazil's early adoption of clean energy arose from developmental concerns and not environmental concerns. It is also believed that Brazil's prominence in the international climate change regime had its origins in its (environmental) security and its desire to be projected as a regional power (Lutzenberger 1992). This environmental consciousness grew out of Brazil's military rulers' conception of 'grandeza,' or a means to achieve 'national grandeur' by taking a stand in the world stage (Cole and Silverman, 2011). Even though Brazil created its first environmental secretariat in 1973, it didn't have much substance or teeth (Hochstetler and Keck 2007). The environmental movement had already started to take root in the end of the 1970s as the military began easing into a democratic transition, though this movement was led more by the people than the state (Alonso and Clemencon 2010). After democratization, Brazil's attention started to gradually move towards the environment and its constitution of 1988 actually contained a whole section on environment (Zago and Nobre 1998).

This was to be the start of a new phase where Brazil wanted to project itself as a credible global problem solver; the environmental platform was the perfect setting for Brazil to assert itself given the intimate association of the country with the Amazon. Thus, while previously Brazil's Foreign Ministry, the Itamaraty, was the sole actor negotiating its stand in international conferences from 1992 onwards the president started to take a more active interest. This interest was initially due to pressure from external actors but later out of strategic reasons related to the projection of the country's status as a problem solver (Cole and Liverman 2011). Beginning from the 1992 'United Nations Conference on Environment and Development Summit' in Rio it was recognized that the complexity of the environmental issue would have to be addressed by different actors like NGOs, academics and the scientific community and definitely by political power heads. Pressure from environmental groups and even the World Bank, compelled the Brazilian President Fernando Collor de Mello offered to host the Earth Summit in 1992 (Cole and Liverman 2011). By this time, Brazil had become deeply involved in climate politics and it was was instrumental in framing the 1992 UN Convention on Biodiversity and later it also put forward the Brazilian Proposal—whose Clean Development Fund was the basis of the inspiration for the CDM—an important work that is still being fine-tuned to this day.

Kyoto Protocol: Evolving a Global Climate Policy

The evolution of global climate policies has taken many decades to finally converge in the framework provided by the United Nations Framework Convention on Climate Change (UNFCCC) and subsequently, the Kyoto Protocol. This section is divided into two main parts; the first part gives a brief overview of the gradually increasing focus of attention on climate issues by the international community, culminating in the formation of the UNFCCC; the second section focuses on the actual Kyoto Protocol and the two flexible mechanisms, the Clean Development Mechanism (CDM) and emissions trading, that will be dealt with in this dissertation. [10] The section on CDM is preceded by a narrative on the Brazilian Proposal which was the precursor to the CDM.

Global Attention to Climate Change

The global spotlight on climate change is relatively new and it was first trained on climate and environmental issues when activists, NGOs and the general populace led the celebration of Earth Day in 1970. [11] Shortly after, the United Nations' Conference on Human Environment was organized in 1972 at Stockholm. At the Stockholm conference, Brazil was part of a collective of developing nations against the inclusion of global environmental issues into international policymaking. This is because it was seen as destructive to their development agenda and shifted the costs of protecting the environmental commons onto the developing world.[12] It was in the same decade that climate change finally got an international reception at the first World Climate Conference in 1979. The next major

[10] The third flexible mechanism is Joint Implementation.

11 Though the motivation behind the first Earth Day was political, the base of support was grassroots with community participation. Initially there were two simultaneous Earth Days- one supported by the United Nations and the other (which pioneered the one celebrated on April 22 each year) which was a political rally of sorts in San Francisco.

[12] The Brazilian military linked the idea of the sovereignty of the state and with the environment and argued that it was a sovereign right to develop an area including an ecosystem (Cole and Silverman, 2011). Including environmental concerns in global policy would mean finger pointing at the emissions-intensive industrialization of developing nations and directives on the management of their environmental resources.

breakthrough in climate change negotiations occurred in 1983 when the United Nations General Assembly passed Resolution 38/161 which established the Brundtland Commission. Finally concerns about the climate were gaining mainstream attention. The Brundtland Commission, or the World Commission on Environment and Development (WCED), was created in recognition of the global impact of environmental problems. Amongst its aims, as stated in the resolution, was the proposal of 'long-term environmental strategies for achieving sustainable development to the year 2000 and beyond' (General Assembly Resolution1983:1). The eighties were a decade of climate milestones and it was in that period that it was first expostulated (and later endorsed in the fourth assessment report of the IPCC) that a temperature rise beyond 2 degrees over the levels in 1850 would devastate the environment[13] (IPCC 2007). The decade also hosted a slew of scientific and political conferences that focused on climate change in Villach (1985); Hamburg and Montreal (1987); and Toronto (1988). The Montreal Protocol on Substances that Deplete the Ozone Layer was a treaty adopted in Montreal in 1987 to phase out halogenated hydrocarbons which were shown to contribute to the breakdown of ozone molecules. 1988 was a key year for the politicization of climate as the IPCC was formed and this was also the year of the first United Nation's General Assembly Resolution on Climate Change (IPCC 2007). In 1989, climate change was a topic on the agenda of diverse political and economic groupings like the G7 Meeting, the Non-Aligned Movement's (NAM) summit in Belgrade, and the Commonwealth Summit discussed the climate change issue.

It was finally in 1992 that countries came together in Rio de Janeiro under the UNFCCC, an international treaty to limit global climate change. This was the culmination of the work done by the Intergovernmental Panel on Climate Change and the International Meteorological Organization. With its secretariat in Bonn, the UNFCCC was to provide a framework for the development of laws, a legal infrastructure, administrative bodies and a deliberative process for the parties to the conference to achieve the UNFCCC's objectives (Bettelheim and D'Origny 2002). Its primary objective was given expression in the

[13] This view received increased traction when the European Union adopted the 2 degree rule based on data provided by NASA's GISS land-ocean temperature anomalies and the Hadley Center's HadCRUT3 database. In 2009 the G8 + 5 economies (which included Brazil) also agreed to not let global temperatures exceed 2 degrees over the early industrial (1850) era.

preamble to the UNFCCC which assigned to the states the responsibility for mitigating the 'dangerous anthropogenic interference with the climate system' by enacting 'effective environmental legislation' (article 2, UNFCCC 1992). Significantly, it also admitted that 'standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries' (UNFCCC 1992). The UNFCCC was ratified by Brazil in 1994 and it entered into force the same year as well. From 1995 onwards, there have been annual conferences known as the Conference of the Parties (COP) held for the signatories to the UNFCCC; with the first one, COP 1, being held at Berlin.

Kyoto Protocol and the Flexible Mechanisms

International climate policy aims at achieving the two crucial objectives of climate stabilization and the balancing of developmental needs and the Kyoto Protocol was adopted as a tool to achieve these twin goals. It was at the third Conference of Parties (COP 3) in 1997 in Kyoto—after a considerable number of consultations amongst various stakeholders—that the Kyoto Protocol came into existence (Oberthur and Ott 1999).[14] This process had taken a few years of intense international negotiations, with the very first draft proposal being undertaken at the first COP in Berlin. Known as the Berlin Mandate, this proposal sought to impose time-bound quantitative emissions reductions targets for certain countries. The Kyoto Protocol represented the most acceptable iteration of this original mandate (Johnson 2001). Since the UNFCCC itself doesn't create legal obligations (Asselt and Biermann 2007), the Kyoto Protocol was accepted as a means to set legally binding GHG emissions limitations for industrial countries.[15] Thus, one of the Protocol's goals were to *commit* rather than just *encourage* industrialized countries to stabilize GHG emissions.

[14]Since Non-Ozone depleting gases weren't regulated by the Montreal Protocol (also known as the most successful international agreement to date by Kofi Annan), it was necessary to design a treaty like the Kyoto Protocol which addressed GHGs that had a warming effect (Oberthur and Ott 1999).

[15] These GHGs were carbon dioxide, nitrous oxide, sulfur hexafluoride, methane, hydrofluorocarbons and perfluerocarbons.

To achieve the UNFCCC's aims and enforce emissions limitations the Kyoto protocol provides for three market mechanisms, the Clean Development Mechanisms (CDM), Joint Implementation (JI) and Emissions Trading, also known collectively as the flexible mechanisms. These flexible mechanisms are intended as a supplementary means (other than domestic mitigation action) for countries with binding emissions targets to meet their mitigation goals (UNFCCC 1997). They allow geographic and temporal flexibility to nations (Dutschke and Michaelowa 1998). JI and CDM are the project based mechanisms. CDM allows and encourages Annex I countries (industrialized countries and countries with economies in transition that are signatories to the Kyoto Protocol) to assist in the sustainable development of developing countries by installing low cost, environmentally optimal emissions reduction projects in return for carbon credits. The project based approach of the CDM means that there are new credits created with each new project (Boyd et al. 2009). Thus, in theory there isn't a limit to tradable units for each project under CDM. The second mechanism is joint implementation which is a means for single or multiple annex B countries (countries that have accepted reductions targets under Kyoto Protocol) or private investors from those countries to make investments or provide technology for emission reduction activities in other annex B countries (article 6, Kyoto Protocol 1997). The third mechanism is emissions trading which allows countries or private entities to trade the carbon credits generated through CDM and JI projects or for annex B countries which have unused emission units from their allowed emissions quota to sell their excess emissions units to other nations or companies. Interestingly, even intergovernmental organizations like the United Nations and private companies in developing nations have started purchasing carbon credits for reasons like goodwill creation and corporate social responsibility.

In the carbon market the most common tradable units are the Assigned Amounts Unit (AAU), Removal Units (RMU), Emission Reduction Unit (ERU) and Certified Emission Reduction (CER). Each one of these units are equivalent to one tonne of CO2 with the calculation of RMUs on the basis of land use, land-use change and forestry (LULUCF) activities such as reforestation, ERUs on the basis of joint implementation projects and CERs generated from a CDM project activities (UNFCCC, 1997). The AAU is the most commonly traded unit which represents the quantum of allowed emissions (divided into small units which are each equivalent to one tonne of CO2) for annex B countries. Thus, if annex B countries have AAU emissions units to spare, they can sell those units to other annex B countries that have exceeded their targets (UNFCCC 1997).

However, the Kyoto Protocol hasn't been greeted with unanimous enthusiasm by all the parties to the UNFCCC. There have been opposing voices from both the developed and developing world over the issue of taking responsibility for climate change and making the growth-related sacrifices that are required for mitigation. The resistance to the Kyoto Protocol from the developed world is primarily because it places the onus of responsibility for high GHG emissions on developed nations under the principle of 'common but differentiated responsibilities' (Van Kooten 2003). The developed world has demanded that there be similar emission constraints on the developing world especially emerging economies like Brazil, India and China. However, imposing blanket rules or obligatory emissions reductions targets for non-Annex I countries (signatories to the Kyoto Protocol that are not in Annex I) will be counterproductive because of the disparate composition of this group[16]. As of now, emerging economies [17] like Brazil and impoverished nations like Bangladesh have been all grouped together. Kyoto needs to include separate rules for each category of nations within the non-Annex I grouping so that countries belonging to the latter group which are responsible for only negligible emissions are not penalized. Brazil is an example of a developing country that is a supporter of the Kyoto Protocol and it has always championed it and maintained that the Protocol is the most promising international climate change policy tool available, ratifying it in 2002. Brazil was also the first country to get its CDM methodology approved (La Rovere et al. 2002). Brazil's official stand was that the Kyoto Protocol with its flexible mechanisms embodied the fair principle of common but differentiated responsibilities and it was viewed as the most appropriate legal instrument for reaching and directing global climate change targets (Brazil Climate Change Policy,

[16] Annex I countries are those industrialized countries (and transitionary economies) which are signatories to the Kyoto Protocol. Non-annex I countries are the industrialized and transitionary economies that have ratified the Kyoto Protocol but have not taken on reductions obligations.

[17] There is a distinction being made here between the emerging economies, like Turkey, of annex I and non-annex I emerging economies which are characterized by vast sectors of poverty and widespread inequality.

Government of Brazil 2007). Even before the adoption of the Kyoto Protocol, Brazil had innovated the concept of a Clean Development Fund, providing a framework to structure the UNFCCC's emissions reduction programme, which later evolved into the Clean Development Mechanism.

The Evolution of the Clean Development Mechanism: The Brazilian Proposal

As the precursor to CDM, the Brazilian proposal can provide valuable clues about Brazil's expectations of what the CDM or Kyoto's flexible mechanisms ought to achieve in order to mitigate climate change: fixing responsibility for climate change, allowing the developmental agenda of the Southern nations to continue unabated and securing financial and technical assistance for climate change mitigation and adaptation.

The Brazilian Proposal is based on a scientific conception of burden sharing in mitigation activities. It arose in the context of Brazil's efforts to mitigate carbon emissions before they reached an alarming level and the resistance of international efforts (originating from the US and IPCC) to set emissions quotas based on current emissions (Cole 2010). Other than the US even emerging economies like Brazil, India and China have objected to emissions quotas on current levels because even though their absolute level of emissions at present is higher than that of the developed world, their per capita emissions are a fraction of those of the developed world.

In the present, the Brazilian Proposal has come to refer to the setting of different emissions reductions targets based on the historical contribution of and relative responsibility of nations for climate change (La Rovere et al. 2002)[18]. The seed for this proposal was planted in the first COP held in Berlin in 1995 with the adoption of the Berlin Mandate which acknowledged the need to set emissions limitations for annex I countries. As an evolutionary approach to the Berlin Mandate, member countries of the UNFCCC could submit proposals for the 'quantified emission limitation and reduction objectives' for annex I parties which would be included in the Kyoto Protocol. The Brazilian Proposal was one of the submissions and it was a collaboration between intellectuals, the scientific community

[18] It basically establishes targets to limit emissions with implementation modalities being left open for future negotiation.

and the Ministry of Science and Technology (MCT) of Brazil. The Proposal called upon annex I nations to make a 30 % reduction in greenhouse gases using 1990 as a baseline by 2020 (UNFCCC/AGBM/1997/MISC.1/Add.3). The 30% GHG reduction targets were applied as a whole on the collective Annex I grouping and served as a cap on emissions. The methodology in the proposal determined the historical share of different annex I nations to climate change and also the different targets each country would need to adopt. Thus, countries that industrialized earlier would generally have the highest GHG reduction targets, a matter that continues to foster dissent (Hohne and Blok 2005). Therefore, even though certain countries like United Kingdom had a 66% reduction target some kind of agreement could be worked out between the countries to 'trade' a portion of the targets (La Rovere et al. 2002) to average a 30% reduction.

The purpose of the Clean Development Fund (CDF), which grew out of the Brazilian Proposal, was to give mitigation assistance to the developing world. Brazil proposed that the fund be used to give non-Annex I countries the access to financial assets and clean technology for climate change mitigation and adaptation. Annex I nations that didn't meet their emissions reductions targets were to be fined. Non-Annex I countries could apply for financial assistance from the CDF primarily for GHG reduction with a small portion set aside for adaptation projects (La Rovere et al. 2002). Though some elements of it have been incorporated into the Kyoto Protocol, the Brazilian Proposal wasn't accepted in its original form because of the opposition to it by industrialized countries who considered it prejudicial to their interests and felt it was unfair to penalize them based on past actions (La Rovere 2002). The reason the Kyoto Protocol was more acceptable was because it sought to bring about *voluntary* targets albeit, those that were enforceable once the pledge to commit to a certain target was taken (Cole 2010).

The Clean Development Mechanism and Brazil

The Clean Development Mechanism (CDM) allows developing countries to earn tradable and saleable Certified Emission Reduction (CER) credits for each tonne of CO2 reduced or saved. The benefit for industrialized or annex I countries is that the market mechanism helps them meet a part of their emissions reduction quota as mandated under the Kyoto Protocol while reducing compliance costs (Pearson and Loong 2003). The payoff for developing countries is that CDM is expected to facilitate the access to technology and resources for mitigation activities without impeding their economic development (Sari 1999). Also, the UNFCCC's Adaptation Fund, established to 'finance concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change' is also funded mostly through CDM projects (UNFCCC, 1/CMP.3). Two per cent of CERs issued from CDM projects are invested towards the Adaptation Fund that allows direct access to the funds for recipient countries (Brown, Bird and Schalatek 2010). The rationale behind allowing countries direct access to this fund is that it increases the country's ownership, accountability and control to create nationally appropriate mitigation and adaptation programmes (Brown, Bird and Schalatek 2010).

For CDM to be successful, an institutional structure is required to support projects from the inception to the verification stage. While the mechanism is already supported by a comprehensive set of institutions, if the country hosting the CDM project has inadequate regulatory systems and weak institutional capacity, investors will be vary promoting more projects. Fortunately for Brazil, it already has in place the perfect combination of investment-friendly governance and regulatory systems; and professionals who have a wealth of experience in clean energy and a well oiled information sharing system in place (La Rovere 2011). Also, Brazil has recently fostered a new tribe of project developers who are intimately acquainted with the environment in Brazil and know which projects will give the best yields—a fact that has given a boost to niche, small scale CDM projects in Brazil.

All CDM projects are not created equal, however, and a negative trend has been the rising adoption of end-of-pipe fixes. 'End-of-pipe fixes' is a term used to criticize the profit seeking orientation of many CDM project promoters (Driesen 2008). These projects give quick reduction results and give high returns on investment because of their great emissions reduction capabilities. Many CDM projects focus on nitrous oxide (N2O) and hydroflurocarbon (HFC) reductions because they have a high global warming potential and can therefore, earn more carbon credits. [19]Thus, more carbon credits can be earned out of these projects (though they are fewer in number) even while they have fewer sustainability benefits (Cosbey et al. 2005).

The Rationale for Brazil's Adoption of CDM

A strong case has been made for Brazil's active participation in CDM. These benefits fall under five main categories:

1) Institutional Support: Without the institutional support given by the CDM, the new clean energy revival would in all probability have taken longer (Americano 2008). This is because CDM catalyzed the processes of institution making related to the verification, monitoring, financing and smooth functioning of CDM projects.

2) *Brazil's Rich Potential for CDM Project Implementation:* Kyoto's flexible mechanisms can work in perfect tandem with Brazil's national climate change plan and the specific natural endowments it has. In fact, Brazil accounts for approximately 41% of the expected emissions reductions from CDM projects in Latin America by 2012 (Boyd et al. 2009). Brazil has rich forest resources in the form of the Amazons which can be valuable in the forestry sector of CDM projects; it has a huge potential for renewable energy projects such as hydroelectricity, wind energy, biomass energy, energy efficiency, urban landfill management and so on. The importance of CDM in energy sectors is emphasized by an analysis of the sectoral share of annual CO2 emissions reductions in Brazil—the greatest share is in renewable energy (51%), followed by swine waste projects and then fossil fuel switch projects[20] (Brazil Ministry for Science and Technology 2009 quoted in de Oliveira 2009).

3) *Assistance in Making Structural Changes:* CDM has helped ease Brazil's transition into making economic structural changes. For instance, in its energy production sector which was previously dominated by hydroelectricity (which isn't always an ideal strategy in drier

[19] For instance, the Global Warming Potential (GWP) for N2O is 3102 (IPCC, Second Assessment Report 1996).

[20] Fossil fuel switch projects are when the primary fossil fuel energy source is replaced by a clean and renewable source of energy.

regions), CDM incentivized alternate forms of energy like wind and biomass. CDM has introduced efficient modes of production and new practices in environmental management in towns, thus, creating whole new sectors where there were none before. An example of this is the landfill projects in Sao Paulo which have utilized inputs commonly thought of as waste to generate energy and manure (La Rovere 2011; Americano 2008). Americano (2008) lauds the structural changes brought about by CDM projects which have turned unique practices into everyday practices.

There is a pressing need for structural changes to be made in Brazil's energy sector. There are four main sources of emissions in Brazil which are land use change, agriculture, forestry and animal husbandry and energy. However, the share of energy in Brazil's emissions is set to increase even though Brazil's current energy use consists mainly of renewable forms like hydroelectricity and renewable biomass like ethanol and biodiesel. This is because, in order to meet Brazil's growing energy needs, the share of fossil fuels has been rising steadily—with an increase of 68% from 1990 to 2005—as increasing industrialization has meant a growing reliance on conventional fuels (La Rovere 2011). Thus, this structural change will take place if CDM can encourage a large scale and sustained investment in new renewable energy projects which can cover the energy deficit in the country.

4) *Technological Transfers:* CDM also provides technology transfers without which Brazil's ability to achieve a sustainable energy mix would become difficult. Novel and clean energy sources often require massive financial investments because of the time and skilled research that is required to create new solutions. In fact, even relatively common project types can run into obstacles because of geographic or climatic conditions. For instance, Brazil witnesses considerable losses while transmitting hydroelectricity to end-users— losses which can be overcome with technology transfers (La Rovere et al. 2007). Also, while Brazil is expected to rely on hydroelectricity to meet most of its power-generation needs, with existing hydropower sites already in use and water channels being situated far from central locations, this could be an expensive proposition. Therefore, technological transfers can help alleviate the escalating costs of supplying hydro power (IEA 2006). De Lopez et al.

(2009) also recognize the importance of technological assistance in encouraging CDM activities in other areas.

5) *Financial Incentives:* When investment decisions are left largely to the private sector, there is a tendency to focus on the profitability of investment decisions. However, the CDM incentivizes the kind of projects that would generally be the onus of the government, such as energy and reforestation. By giving assistance to project developers and giving them the opportunity to earn profit for undertaking environmentally friendly projects, CDM and emissions trading enhance participation in conventionally avoided sectors. These incentives can also be adopted in Brazil's domestic legislation. This is already being done to some extent with different Brazilian governmental bodies like ministries and municipalities encouraging the implementation of development oriented CDM projects like public transportation and reforestation.

Emissions Trading and Brazil

Emissions trading is a market mechanism, provided for under article 17 of the Kyoto Protocol, commodifying GHG emissions which can be traded between two countries or between countries and corporate entities (Article 17, Kyoto Protocol). Emissions trading offers Brazil the advantages of encouraging energy efficiency, fostering collaboration, allowing flexibility, inculcating corporate responsibility amongst firms, consolidating preservation efforts, forging socially desirable benefits and reducing the cost of compliance for emissions reductions.

Countries like Brazil that do not have binding targets may also use emissions trading by enacting domestic legislation to meet unilateral emission reduction targets or to foster corporate responsibility and encourage the best production practices (La Rovere 2011). Article 17 is deliberately non-committal in methodology and emission trading procedure and gives regions the flexibility to create their own nationally appropriate trading modalities (Yamin 2005). However, parties must comply with the provisions of the protocol and the Marrakesh Accords on emissions trading. In keeping with this, Brazil instituted the

Brazilian Emissions Reduction Market—MBRE (Mercado Brasileiro de Redução de Emissões) (National Climate Change Policy, Government of Brazil 2009). [21]

In Brazil's context there have been three primary benefits of emissions trading:

1) Setting a Price for Carbon: Firstly, emissions trading could eventually help set a price for carbon through the interaction of market forces of demand and supply and this would help determine the real costs of reducing GHG emissions (Baron and Colombier 2005). The second benefit of emissions trading was to minimize the costs of GHG reductions (Baron and Colombier 2005). This is because parties that were exceeding their emissions quota would not be required to invest heavily in abatement costs and could instead reap the benefits of another's efficiency.

2) Tool for Preservation of Forest Resources: Emissions trading has been touted as a potentially valuable tool to preserve Brazil's tropical forests in the Amazon region because it provides incentives like monetizing the preservation of forests and linking social benefits with the preservation of the tropical forests (Dudek and Leblanc 1992). However, the main challenge has been the formulation of a CO2 (or other GHG) equivalent for each unit of destroyed forest. This way if Brazil were to commit to emissions reductions in the future, forest preservation could make a valuable addition to Brazil's stock of carbon credits given the large expanse of the Amazon.

3) Social Inclusion Benefits: Emissions trading fosters social linkages by reinvesting money earned through emissions trading in the communities that are vested in those projects (Saunders et al. 2002). When people are more closely linked to the environment and they see benefits accruing to them through the preservation of the forests they will be more likely to act in concerted efforts with firms and the government to counter deforestation (Agrawal et al. 1997; Berkes 2007).

A Brief Account of Brazil's Institutional Support to the Flexible Mechanisms

[21] The MBRE is mandated to operate in futures and stock exchanges, commodities, and in over-the-counter trading companies where negotiations for securities representing certified avoided GHGs can take place (Brazilian National Climate Change Policy 2009).

While the flexible mechanisms have been hailed as the antidote to Brazil's mitigation concerns by providing the perfect set of institutions, Brazil too has been equally obliging with its support to the mechanisms. It is true that the Kyoto Protocol provides the sole means for developing countries like Brazil to engage with GHG mitigation efforts in the international arena (Palmer and Engel 2009). In spite of this, the United Nations (UN) and other international treaties have been inadequate in addressing all the concerns of every participant due to the asymmetrical balance of negotiating power of the different parties to the agreements (Betsill and Bulkeley 2007). In this scenario, endogenous mitigation programmes have been seen as an effective supplementary way of ensuring the adoption of the most appropriate plan of action (based on international climate regulations) for developing countries like Brazil (Palmer and Engel 2009). Such programmes ensure that differing viewpoints are accommodated and that all stakeholders are addressed and brought into the mainstream. Local arenas of governance are also gaining increasing currency because of the acceptance of researchers that the sources of climate change operate at that level (Dodman 2009).

Brazil is also serious about providing robust institutional support for CDM projects without which the mechanism would fail. An example illustrating this dual institutional support in Brazil is its implementation of the Programme of Incentives for Alternate Electricity Sources (PROINFA) in 2002 which aimed at promoting renewable energy sources, particularly biomass, wind and hydro power. This programme gave additional rebates and assistance to private players in renewable energy. In fact, PROINFA has worked in conjunction with the Brazilian National Development Bank (BNDES), to provide upto 70% financing for these projects (La Rovere 2011). PROINFA was revised in 2004 to include its second phase which aimed at increasing the share of renewable energy to 10% of all energy consumed which worked as an additional lure for CDM projects in such sectors. To ensure that project developers weren't left with unused energy, Electrobras which is Brazil's power company, arranged to buy the energy at a minimum guaranteed price, thus ensuring that CDM projects with a long incubation period aren't ignored by project developers (Olsen 2007).

Theoretical Background

Climate change discourse is dominated by three theoretical perspectives—economic, environmental and sustainable development. Environmental perspectives are mostly subsumed under economic theories because of the overlap between ecological conservation and market orientation which is so central to the Kyoto Protocol's flexible mechanisms. One perspective which is often short changed is the pure development theory which is represented mostly by Southern voices. This is however, given some representation in economic theories of climate change under the environmental Kuznets curve section mainly as a response to the developed world's demands that developing nations make concessions on their growth trajectory. Considering the context of this dissertation, theories of institutionalization are also represented to explain some of the prerequisites required for a successful climate mitigation programme based on CDM and emissions trading.

I Economic Theories

In the nineties, liberalization fostered a debate on how the new trade regime would impact the environment, particularly with developing countries still relying on primary exports. Ideally, emissions trading in an open market facilitates economic efficiency because there will eventually be a uniform price for carbon (Baron and Colombier 2005). However, there are fears that market mechanisms would lead to deteriorating values for the environment particularly in developing nations (Pearce and Turner 1990; De Lopez et al. 2009). These arguments encouraged restraint in the implementation of forest centered emissions trading (Babiker et al. 2002; Niesten 2002).

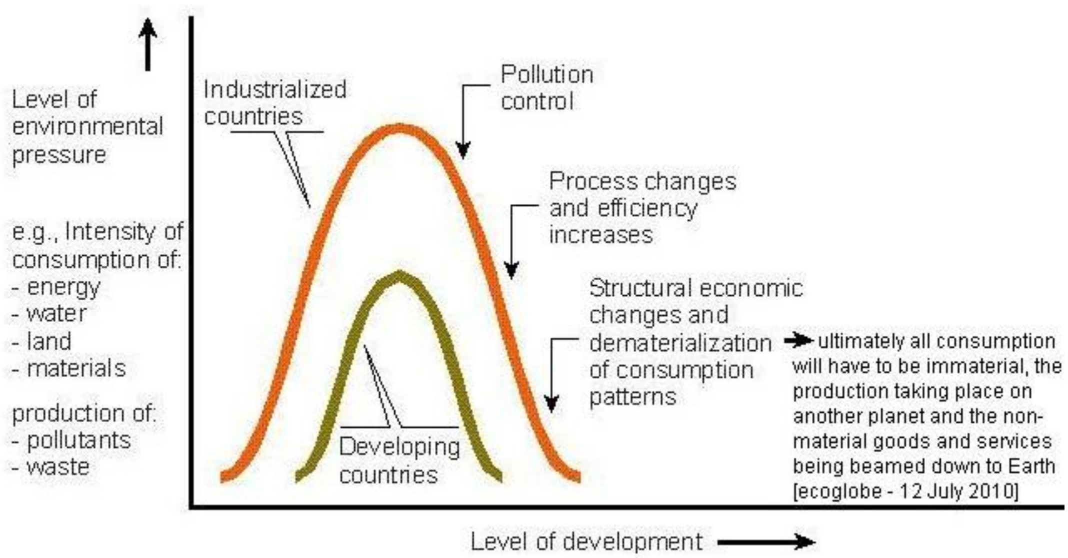
Another school of thought believes that emission trading allows an upward rate correction of environment goods because the market treats the environment like a scarce resource. It is also suggested that emissions trading gives polluters an incentive to use the alternatives created by the flexibility mechanisms to achieve their emissions targets at the lowest possible cost (Tietenberg 2000).

An example of how the market oriented economic perspective can be beneficial is through the study of newer emissions trading modalities like RED (Reducing Emissions from

Deforestation) and now, REDD (Reducing Emissions from Deforestation and Degradation). These modalities use financial incentives, like tradable credits, to reduce greenhouse gas emissions from deforestation and forest degradation (Ebeling and Yasué 2008). Ebeling and Yasué (2008) demonstrate that trading carbon credits from REDD can generate substantial funds for tropical forest conservation. Anger and Sathaye (2008) concur with this view and believe that including avoided deforestation, a recurring demand of Brazil's, will bring down abatement costs for mitigation. The disconnect between energy and environmental issues has been rued by some (Serroa da Motta et al. 2000) and the move towards consolidating the two through market mechanisms like emissions trading has been cautioned against by some (Oikonomou et al. 2010).

The Econometric tool of the Environmental Kuznets Curve is offered as an endorsement of the need to allow developing nations to follow a normal growth trajectory (Barbier 1997). In economics the Kuznets curve is a u-shaped curve which shows how initially development leads to rising inequality till it eventually tapers off into reducing inequality levels in the population (Dasgupta et al. 2002). The illustration below, demonstrates this perfectly. The x-axis plots the level of development and either per capita income or GDP and the y-axis shows the level of environmental pollution as well as the levels of consumption. The graph plots a similar trajectory for both developing and developed nations, however, the pace and intensity of the effects are felt differently.

Graph 1: Environmental Kuznet's Curve



Source: UNEP Global Environment Outlook 1997

The environment Kuznets curve illustrates the hypothesis that pollution and environmental damage increase in the early stages of economic growth but after a certain level of per capita income is achieved there is a relative improvement in the environment. Thus, while in the early stages Brazil's development agenda will lead to an inevitable spike in pollution levels because of the growth of industries and use of carbon intensive energy, eventually, this increase will taper off as the people reach a certain income threshold (Dasgupta et al. 2002). One of the reasons, is that the heavy carbon-intensity of setting up industries will no longer be required since there will already be a basic and stable level of industrialization. The other reason for this tapering off is that the people will, presumably, have access to cleaner, efficient and advanced technology. However, there are sceptics of this phenomenon like Perman and Stern (2003) who believe the environment Kuznets curve is the product of bad econometrics and therefore can't be replicated in the real world. It is argued by some that in the real world, the reverse trend can be a result of conscious national policy decisions, institutional changes or social factors (Banuri and Opschoor 2007).

Technological Transfers and Market Mechanism

The UNFCCC (1995) has endorsed the creation of mechanisms to help industrializing countries meet their development objectives in an environmentally sustainable way through technology transfers amongst other things. Technological collaboration is endorsed as a low cost, efficient, politically expedient solution for CDM projects (Criqui and Viguier 2000; Wilkins 2002; Morsink et al. 2011). The conflict between developing and developed countries arises from the preferred modalities of technology and grant transfers with developing countries preferring direct grants and limited restrictions on intellectual property rights and developed countries in favour of the market mechanisms (Morsink et al. 2011). Kulkarni (2003) gave a critique of the transfer of technologies from developed to developing nations under market mechanisms. She disputes the claim that these mechanisms facilitate ecological sustainable development that is socially equitable because of the high costs incurred. Responding to the need for effective technology transfers (Wilkins 2002; Morsink et al. 2011) there have been proposals for the creation of multi-stakeholder partnerships which reconcile the desire for grants by developing countries with demands for the protection of intellectual property as an enhancement of the mechanism for the transfer of technology by developed countries.

Critique of Profit Motive

The CDM is criticized by some as being straddled with structural flaws which create a conflict between its sustainability and environmental integrity with the requirement for economic feasibility and an emphasis on strict procedural compliance (Voigt 2008). This is because of the desire for maximizing CERs and minimizing the costs for GHG reductions by all the invested parties like the project developers, governments and other investors. The danger is that of the twin objectives of reducing compliance costs while achieving sustainability, the pursuit of the first is proving a hindrance to the accomplishment of the second objective (Pearson 2004).

Another criticism is that because the CDM and emissions trading are offset mechanisms[22], they allow developed annex B countries to exceed their climate quotas under the Kyoto Protocol by purchasing credits even while not making any emission reduction efforts within their own countries (Voigt 2008). Finally the procedural complexity of projects and emissions trading regulations has fostered a long chain of intermediaries who're only interested in financially milking each project. Considering the excellent rate of return on some end-of-pipe projects like nitrous oxide (N2O) reductions, critics are wary of the way the profit motive has usurped the environmental one (Andrade et al. 2011). Financially, there has been a tendency to apply for end-of-pipe projects like nitrous oxide reductions (Andrade et al. 2011). Renewable energy projects are relatively more expensive and earn fewer CERs. To combat this, Cosbey et al. (2005) recommend a policy based rather than project based CDM approach. So, in the Brazilian context and as per Brazilian policy priorities the energy, transport and energy efficiency sectors should be engaged more (La Rovere 2011) and projects in those sectors can be given preferential approval.

II Climate Change and Sustainable Development

The Brazilian National Climate Change Policy identifies sustainable development as key to addressing climate change and servicing the specific needs of the different communities of Brazil (National Climate Change Policy 2009).

Sustainable development is an essentially contested concept but it is generally agreed that in the context of climate change sustainability is synonymous with poverty reduction (Agerup et al. 2004; Beck 2010). Poverty reduction can't be accomplished if developmental needs are compromised by compelling poorer nations to pare down their process of growth.[23] In the 1970s the developed 'north' called for 'zero growth' to minimize pollution while the developing 'south', particularly Brazil under military dictatorship, argued that pollution was a problem created by the former not the latter and therefore placing economic growth

[22] Carbon offsets allow a country to compensate for exceeding its quota of emissions.

[23] Climate Science (IPCC, 2007; Banuri and Opschoor 2007) show that there will be a catastrophic increase in global temperatures when atmospheric CO2 concentrations reach 450 ppm where 430 is already the current level. So the remaining 'quota' of 20 ppm should be utilized in a way that allows maximum development with the least environmentally disruptive means (Banuri and Opschoor 2007). This is the sustainability approach.

constraints was ludicrous (Cole and Liverman 2011)[24]. This call for slowing growth was based on the premise that growth is fuelled by carbon based conventional energy—a key input that is often demonized in the climate change discourse for its contribution to GHG emissions. Critics of the climate policy endorsement of low carbon development believe this approach comes from the political and economic experiences of the industrialized world which has already fulfilled a major part of their development objectives (Beck 2010; Banuri and Opschoor 2007).

A growing body of literature showcasing the 'southern' perspective often rues the marginalization of sustainability in the climate change architecture, which is seen as insufficient to support development (Najam et al. 2003; Olsen 2007). The sustainability criteria draws attention to the dichotomy within conceptions of development–the overdevelopment of the developed countries which focuses on luxuries and the development of poorer countries which addresses the access to basic requirements for living in dignity such as food, housing and transportation (Cole and Liverrman 2011). Theorists like Beck (2010) castigate the idea of equating modernity with environmental degradation saying that it is akin to dividing the world into a caste system which renders the poor of the world to an existence without energy. In fact, a school of thought that includes the World Bank (1992) equates poverty with environmental degradation because it is the poor who are seen as guilty of unsustainable practices (Duraiappah 1998). There needs to be an alternative development path but not at the cost of those who aspire to meet the developed world in their level of endowments. Banuri and Opschoor (2007) treat climate stabilization and economic development as interrelated concepts and stress the need to separate responsibility (for emissions) and funding from action. They criticize the Kyoto Protocol for essentially separating the climate policy and developing.

[24] One of Brazil's Zero Carbon initiative Clickárvore (ClickTree) was started by the NGO Mata Atlântica Foundation aimed at erasing the ecological footprint of past carbon emission sins. The idea behind this was to rehabilitate Brazil's Atlantic Forest, a shrinking high altitude tropical forest which is home to a large number of endemic species. Human settlements around the forest, habitat fragmentation and dependence on forest resources to support livelihoods had destroyed vast tracts of the forest.

The Brundtland Report defines sustainable development as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (Brundtland Report 1987:1). This ability of future generations is limited by the level of accessible resources and the availability of the right technology to optimize the use of their current level of resources. This focus on sustainability is echoed in the UNFCCC’s CDM as well which includes the promotion of sustainable development and the cost effective reduction of GHG and as its two objectives (Article 12, Kyoto Protocol 1997).[25] The Marrakesh Accords of 2001 place the onus of defining sustainability on the country hosting the CDM project (Marrakesh Accords, UNFCCC 2001). This is because the effects of climate change will be felt more acutely in a scenario with gross inequality. Climate change sharpens the divide between the winners and the losers and ‘radicalizes social inequalities’ and Beck (2010) suggests breaking down the parameters of measuring inequality into poverty, social vulnerability, corruption, the accumulation of dangers and the loss of dignity on a global scale and so on (Beck 2010). The additionalities promised by CDM are linked to certain conceptions of poverty reduction like improved livelihoods, increased employment and a better standard of living.

Achieving Climate Change Mitigation through Sustainable Practices

Brazil needs to reach equilibrium between ecological sustainability and economic development. The Amazon region is already ecologically vulnerable. What adds to the dilemma of policymakers here is the fact that a quarter of its economic output is derived from the agricultural sector and forestry—two sectors which contribute to almost three quarters of Brazil’s total emissions (MCT 2009). The international community has often urged Brazil to implement the system of ‘avoided deforestation’. This compensates immediate stakeholders (indigenous people and those whose livelihoods depend on forestry) for not cutting trees and encourages sustainable practices.

[25] ‘The Parties have a right to, and should, promote sustainable development. Policies and measures to protect the climate s\stem against human-induced change should be appropriate for the specific conditions of each Part\ and should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change’ (Article 3, paragraph 4, UNFCCC, 1992).

Even in practice, the need to achieve sustainable development benefits has been experienced in the Brazilian state of Amazonas where a 75% reduction in deforestation was achieved by incentivizing the locals who depend on the forests for their livelihoods. This was done by creating institutions and programmes like a green free trade zone, tax benefits, technical assistance, minimum support prices for nature-derived goods, credit facility and so on (Braga 2009).

In Brazil the objectives of sustainable development for CDM projects can be met by using renewable energy; substituting fossil fuels with renewable energy; co-generating electricity (this can be done through biomass cogeneration); improving energy conservation and efficiency; reforestation and reducing emissions derived from transportation (Brazilian Business Council for Sustainable Development 2003; quoted in UNIDO GLO/99/H06, 2003).

Developmental Theories

Developmental theories of climate change speak of the need for 'decoupling' economic growth from emissions reduction. Banuri and Opschoor (2007) elaborate on the two approaches to climate change policy making: the conventional one endorsed by intergovernmental organizations like IPCC have marginalized development theory in climate change discourse; the second is the developmentalist theory which subscribes to the view that the flexible mechanisms can give better results if developmental goals are assimilated into the discourse (El Rovere et al. 2007). This link between climate change and development is particularly true in the case of developing countries where even moderate climate change can have a politically, economic and socially destabilizing effect. The greatest gains for developing countries comes from first adopting nationally appropriate climate friendly actions before exclusively focusing on only climate policies and this is especially true in the case of the energy sector (El Rovere et al. 2007).

The flexible mechanisms have also been cautioned against for their tendency to distinguish between poorer and thriving developing nations. Researchers like Boyd, Hultman and Roberts (2009) and Wara (2008) have been critical of the CDM's achievement of its stated goals for developing countries, at least in its present context. At present there is a tendency for CDM projects to focus on emerging economies which offer a high return on investments for project partners (De Lopez et al. 2009). This preference for 'viable markets' creates a marked bias not only between developing countries but within countries as well. Therefore, the poorest areas within Brazil with potential for CDM projects with a long incubation time (but could actually have greater sustainability effects) are usually ignored (Cosbey et al. 2005; Americano 2008; De Lopez et al. 2009). Cosbey et al. (2005) question whether the existing range of projects registered under CDM are adequate to provide development.

III Institutionalisation

By certain conceptions, the difference between the developed and developing world is that the latter possesses well entrenched institutions like property rights, contractual freedom, open trade, rule of law and free governance (Axel-Morner 2004). The flexible mechanisms encourage these institutions to flourish (in project regions at least) because these are the minimum requirements for these mechanisms to function smoothly. CDM projects have a tendency to be concentrated in those with high returns and low political risks and encumberments (De Lopez et al. 2009). For instance, defined property rights and rule of law are essential for incentivizing investments in CDM projects from abroad. Also, political risks like civil unrest, unstable and free governments, clientelism and so on also act as disincentives for CDM projects with long incubation periods (De Lopez et al. 2009). Open trade, property right and the right to enter into contracts are essential for the market mechanisms to operate for fixing a value for CERs and for emissions trading to take place. Open governance is also called for to allow transparent processes in the project documentation stage of CDM projects so that sustainable development benefits can be realized (Bumpus and Cole 2010). The market is an impartial construction that works for its own advantage. Therefore, simply hoping development will follow without building institutional safeguards into the system will encourage mutually exclusive results of either financially feasible emission reduction or welfare oriented development.

Conclusion

For effective climate change mitigation Brazil should focus on sustainable development, include community based development while also encouraging CDM projects with community linked additionalities, regulate market mechanisms and foster an environmentally conscious market ethic so that emissions trading isn't misused (Baer et al. 2009). A policy oriented rather than a project based CDM approach will also ensure that the benefits of CDM is long lived and used for receiving a developmental dividend of socio-economic and environmentally valued objectives in Brazil (Cosbey et al. 2005).

CHAPTER II

Brazil's Institutional Support and Regulatory Mechanisms for CDM and Emissions Trading

Introduction

In the climate change regulatory environment the relationship between national governments and international institutions and governance systems is a symbiotic one. When international obligations are synchronous with a nation's domestic goals there is a greater inducement to implement policies that are capable of achieving those objectives. International environmental governance has promoted institutional innovation in both international and national politics (Friberg 2007). With the Kyoto Protocol, in instances where systems of global governance for climate change and sustainable development have failed, there has been enough flexibility to allow national governments to cover deficiencies[26]. The Kyoto Protocol is supported by an unprecedented set of regulatory instruments and institutions which have attempted to offer as much clarity as possible on holding together the global carbon market so as to cost-effectively achieve GHG mitigation (Castro and Michaelowa 2007). However, the very rules that were meant to offer a coherent framework for action have also created compliance related risks because of their sheer expansiveness (Castro and Michaelowa 2007). Therefore, it is Brazil's responsibility to help crystallize norms for project developers and clarify Kyoto's regulations so that they fit within its national context-- a task that requires Brazil to interpret the rules and policy requirements of the CDM and emissions trading modalities in a nationally appropriate way that fosters the development of those market mechanisms.

[26] For instance, the sustainability benefits claimed by CDM are often viewed cynically by researchers who believe most project developers are guilty of merely paying lip service and not delivering concrete sustainable developments. To counter this, Brazil has stepped in demanding a mandatory outline of sustainable benefits in the project design documentation stage of CDM projects.

Till recently, Brazil lacked a very well defined national and regional strategy to cope with climate change (Marengo2011). There were governmental agencies and ministries like the Ministry of Science and Technology that were focal points for framing environmental policies which, unfortunately, lacked the wherewithal for meaningful systemic action (Marengo 2011).[27] What worked in Brazil's favour was its strong degree of interest in the success of the CDM which could be traced back to the Brazilian Proposal suggesting the creation of the Green Development Fund to assist developing countries with emission mitigation activities (Hultman et al. 2009). Kyoto Protocol's flexible mechanisms have provided an additional path for countries to achieve emissions cuts and even though Brazil doesn't have any reductions commitments the flexible mechanisms have helped create 'best practices' for achieving Brazil's national environment and climate goals[28]. Brazil has been on a steady path to reaching its climate related goals through concerted action between its national programmes, the international climate change mitigation infrastructure represented by the Kyoto Protocol and assistance in sustainability provided by the framework of the Millennium Development Goals (Cole and Liverman, 2011). The active engagement of the states of Sao Paulo, Minas Gerais and Amazonas in framing environmental legislation and giving official sanction to the CDM and creation of credit markets has also contributed in a very important way to the success of the Kyoto Protocol in Brazil.

Newell and Phillips (2011) endorsed the synergetic collaboration between the national and international spaces, asserting that the Kyoto Protocol cannot possibly succeed in a vacuum and that it requires politically engaged governance from the host country to make an effective contribution towards climate change mitigation. Conversely, investments earned

[27] However, Brazil has had considerable success with standalone programmes like the National Alcohol Fuel Programme which promoted the production of ethanol based fuel, and its massive drive to build hydroelectric power plants which are responsible for the enviable share of renewable energy in its total energy consumption (Cole and Liverman 2011).

[28] Brazil is deeply committed to achieving environmental and sustainable development goals. The fact that the Kyoto Protocol allows enough (though not always an ideal amount) flexibility to accommodate a country's developmental priorities within CDM projects has made regional Brazilian environmental legislation include the development of CDM projects as a priority. The actionable points for the Rio+ 20 United Nations Conference on Sustainable Development in June 2012 (available at http://www.uncsd2012.org/rio20/index.html) sum up Brazil's ambitions for a future international climate change mitigation framework.

through CDM can help host countries develop national monitoring and accounting systems which can reduce overall costs by creating a single over-arching authority and providing a blueprint for institution building (Peskett et al. 2006). However, none of these complementarities would have mattered for Brazil if it weren't for a vital combination of attributes possessed by it—its excellent institutional framework, high level of multi-party engagement with the international climate community, a congenial investment climate and the scope to host projects across a wide range of CDM approved sectors—all of which have contributed to make the CDM such a consummate success in Brazil (Castro and Michaelowa 2007; Friberg 2007; Hultman et al. 2009).

Institutions and Governance

This section gives a brief overview of the framework of governance and institutions especially those related to CDM, as delineated by the Kyoto Protocol. This section also covers the main CDM regulatory authority in a country, the Designated National Authority. These institutions are an important source of supporting infrastructure for the flexible mechanisms and play a complementary role with Brazil's institutions as well. The international CDM regime merely provides the primary framework or the substratum for the regulatory structure for a country and therefore, it doesn't always guarantee adequate private participation in CDM projects (Benecke 2008). The participation of the private sector and the risk assessment by international funding agencies for the joint financing of CDM projects depends a great deal on the stability and perceived reliability of domestic policy and regulatory frameworks (Benecke 2008). As Michaelowa (2003) asserts, an effective national institutional arrangement is required to give the final push that can increase investor interest and optimize CDM's potential.

Building Institutional Capacity

Institutional capacity refers to 'legal and political settings, governmental entities, research and higher education centres, the media, business and societal organizations, among other factors that may affect the regular performance of some functions' (Willems, 2003:8). Willems (2003) understands this capacity as a systemic concept which defines the limits of what functions the institutional components of a system can regularly perform to meet its purpose (which is climate change mitigation in this case).

The various Kyoto Protocol institutions exercise power in accordance with the Modalities and Procedures of the Marrakesh Accords (Nedergaard and Stehr 2008). The use of market mechanisms instead of just regulatory rules is considered a progressive step in institution building (Repetto 2001). It creates a channel for financial assistance and technology transfer. Brazil has worked rapidly to develop its national infrastructure to enhance the capacity to handle the complex flow of CDM activities. Brazil's institutional environment fulfils Willems' (2003) criteria for meeting climate change challenges: it has been a vocal and valued participant in climate change negotiations; it has formulated an extensive range of climate policies and reporting, monitoring and assessment activities; it exhibits a healthy amount of multi-level coordination in the government; it has a regularly updated GHG inventory—the 'National Inventory of Greenhouse Gas Emissions' which is freely accessible; Brazil's engagement with the UNFCCC has covered scientific, diplomatic and policy levels; Brazil has dedicated research organizations (including its space agency, National Institute for Space Research) studying the effects of climate change; and civil society stakeholders are becoming committed participants in working out climate change mitigation scenarios. A note about civil society and stakeholder participation in Brazil is that even though it actively invites them to issue comments for CDM projects, only about 5% of Brazilian CDM projects actually receive any feedback and input. This is an issue related to inadequate capacity of the civil society participants who lack the technical knowledge or time to study all project impacts. Some project developers try to remedy this on their own (to presumably avoid confrontation at a more advanced stage of the project) by developing a consultation process and hosting public meetings for inclusive community and NGO participation in the project development process (Castro and Michaelowa 2007).

All these reasons have increased investor confidence and their belief that Brazil's institutional framework for supporting and implementing CDM is inclusive enough to overcome lapses and is adequately effective. This also explains the large number of CDM projects worth an investment of $ 1.5 billion that have been registered in Brazil (Thornley et al. 2011).

Silayan (2005) found that countries with an early start in the establishment of institutions benefitted by attracting more CDM investments because of the experience they gained. In Brazil CDM project developers had brought in foreign expertise quite early on for different services related to law, CDM project documentation, methodology, validation, certification and strategic consulting to assess the potential of CDM projects and help in capacity building (Arquit Niederberger and Saner 2005). Brazil's first project 'Brazil NovaGerar Landfill Gas to Energy Project' was a joint project with Netherlands. The participation of Netherlands' Ministry of Infrastructure and Environment as a financial and knowledge partner helped Brazil gain valuable experience and technological assistance in operating CDM projects. It also gave Brazil a head start in the carbon market at a time when there was high demand and low supply of Certified Emission Reductions (CERs). When a country gets a late start in CDM oriented institutionalization there is a paucity of information available about potential opportunities for CDM related mitigation activities (Jeswani and Solis 2006). To circumvent this late start, a three pronged Latin American regional strategy on climate change acknowledging the importance of rapidly building institutional capacity was proposed in 2004 (Vergara 2004). This strategy suggested an early enhancement of institutional capacity in the region through already available institutional development resources and recommended the pooling in of capacities and technologies to allow the members of the region a more influential role in the international climate agenda (Vergara 2004).

Climate Governance

Institutions without governance lack purpose and direction and the UNDP (2004) understands governance as the means to ensure the proper functioning of institutions in a way that gives them legitimacy. Governance is defined as 'the exercise of political authority and the use of institutional resources to manage society's problems and affairs' (World Bank 1991).

Climate governance consists of three functions shared between the international climate governance community and countries (adapted from UNDP1997)[29]:

- Economic governance is the decision making component regarding financial and economic matters. This covers the working of the carbon markets, financial assistance from international donor agencies or climate funds and decisions made by Brazil's government shaping the investment climate (interest rates, liquidity, state of markets and so on).
- Political governance involves the processes related to decision making to formulate policy. The Conference of Parties/ COP Acting as Meeting to the Parties or CMP is responsible for devolving or granting powers with the CDM Executive Board (CDM-EB), Designated Operational Entities (DOEs) and Designated National Authority (DNA). The DOE is an independent auditor accredited by the CDM Executive Board for validating project proposals or verifying whether implemented projects have achieved planned greenhouse gas emission reductions (UNFCCC 1997).
- Administrative governance is the stage of policy implementation. Besides the registration and validation stage the responsibility for implementing the flexible mechanisms lies mostly on the union government in Brazil's case because CDM's locus of control lies in institutional bodies like the DNA which are organized at the national level.

The process of registering a CDM project is a many tiered collaboration between national governments and the UNFCCC's CDM Executive Board. The CDM-EB is the super-ordinate institution for governing the Kyoto Protocol's flexible mechanisms which consists of 10 members and 10 alternate members from parties to the Kyoto Protocol (Stehr 2008). The composition of each group of 10 members is five members from UN regional groups,

[29] The original conception of governance provided by the UNDP is linked to sustainable development, but systems of climate governance follow a similar configuration.

two from annex I parties, two from non-annex I parties and one from the small island developing states (SIDS) (UNFCCC 1997). The Designated Operational Entities act on the mandate of the CDM-EB though they function in a decentralized manner (UNFCCC 1997; Stehr 2008). The CDM Executive Board adopts material rules (regarding which baselines and methodologies are approved) and procedural rules (regarding procedures for the approval of projects, accreditation, validation or which additionality tools are used). The CDM-EB is also the final authority for project registration and issuance of CERs based on the approval given by the host country's DNA and the validation report submitted by the DOE. Among the other roles of the CDM-EB is to develop procedures for the CDM[30], maintaining the CDM registry and maintaining a database with information on proposed CDM projects that require funding and investors in search of funding opportunities.

Thornley et al. (2011) are of the view that even though the complex CDM governance system and exhaustive processes of approving CDM projects creates a political risk for investors it has the advantage of encouraging higher quality projects with scope for greater emissions reductions.

Importance of a Designated National Authority in Climate Governance

The Designated National Authority (DNA) is the primary CDM mandated national institution for the approval of projects (UNFCCC 1997). In Michaelowa's (2003) view there are two Designated National Authority (DNA) models that are effective. An ideal DNA is an independent governmental body with fully autonomous approval powers that is staffed by professionals. This DNA should have a unilateral decision making process free from the conflicting interests and requirements of other governmental bodies or ministries. The second alternative is not as ideal but still quite effective—this is a DNA which works as a two-tiered system consisting in the first level of a CDM board with representation from all the relevant ministries and in the next level, of a CDM Secretariat. The CDM board in this scenario would define the national priorities and the criteria for projects and the CDM

[30] It is suggested that if a country is represented in the CDM-EB, it will result in greater leveraging power and influence on the formation and amendment of rules (Flues et al. 2005).

Secretariat would be the evaluation and approval authority. Brazil's DNA, the Interministerial Commission on Global Climate Change (CIMGC) falls under the second category of DNAs with a strong ministry as the focal point (the Ministry for Science and Technology) working in consultation with other stakeholder ministries. Jeswani and Solis (2006) do warn that though a multi-departmental or multi-ministerial advisory setup has the advantage of drawing upon the expertise of different departments, a need for consensus within the DNA can lead to delays in the approval process.

A country's DNA can affect its extent of participation in the CDM market since the methods of operationalizing the requirements of the CDM-EB are so diverse with the varied requirements of different governments (Hultman et al. 2009). A trained, well entrenched, credible and experienced DNA can attract more project investors because of perceptions of efficiency, low risk and cost-effectiveness (Silayan 2005). Financial constraints are seen as the major barrier in carbon market development in emerging countries like Brazil (Winkler et al. 2005). However, actively engaged DNAs are effective in attracting carbon market investments. The deliberate absence of specific guidelines for establishing DNAs in the Marrakesh Accords was intended to give countries the flexibility to innovate a national appropriate CDM authority that fit in within the country's existing structures (Jeswani and Solis2006). The structure of a DNA impacts the way CDM projects are chosen and approved and also influence the perceptions of investors. Clarity about the host country's regulatory framework through a well structured DNA is a key driver of investor confidence in CDM projects (Arquit Niederberger and Saner 2005).

Brazil's Kyoto Institutions

The three main ministries involved with addressing climate change in Brazil are the Ministry of Science and Technology (Ministério de Ciência e Tecnologia or MCT), the Ministry of Foreign Affairs (Ministério das Relações Exteriores or the MRE) and the Ministry of Environment (Ministério do Meio Ambiente or the MMA) (Cole and Liverman 2011). The Ministry of Science and Technology is the primary ministry involved in coordinating Brazil's national position with the UNFCCC and IPCC and it is advised on climate issues by the Brazilian Space Agency (La Rovere 2002). The MCT has also had a Climate Change Programme since 1994 to address national climate change issues in Brazil and meet its commitments under the UNFCCC.

Brazil's process of institutionalizing climate change is a continually evolving one that keeps growing more comprehensive. Even before the first Earth Summit in 1992, Brazil had established a Climate Change Advisory Unit under the MCT in 1991. Addressing climate change without foregoing sustainable development was a key concern for Brazil which is why the Interministerial Commission for Sustainable Development (CIDES) was formed in 1994 followed by the Sustainable Development and National Agenda XXI Policies Commission in 1997. The Interministerial Commission on Global Climate Change (CIMGC) was established in Brazil through a presidential decree to help coordinate climate change related research and activities in 1999 (Cole and Liverman 2011). With the creation of the CIMGC which served as Brazil's Designated National Authority, Brazil became the first country to appoint a DNA (Friberg 2007). Its constituent members were Brazilian ministries that created policies related to human-origin GHG emissions. It had the Minister of State for Science and Technology serving as the President and the Minister for Environment serving as the Vice-President of the Commission. The Federal Ministry of Science and Technology serves as the Executive Secretariat. This massive network of ministries also takes input from representatives of the Ministries of Foreign Affairs, Planning, Budgeting and Management, Agriculture and Food Supply, Mines and Energy, Development, Industry and Commerce, Transport, Environment and the Civil House of the Presidency of the Republic. The CIMGC has allowed private sector innovation and knowledge generation within a government mandated framework and institution. The Committee actively seeks the collaboration between public and private entities (including civil society representatives) to create policies (Cole and Liverman 2011).

Institutional Factors Affecting Investor Attractiveness

Global trends for the carbon market have been characterized by competiveness between the host countries for carbon investments. For a country to attract funds it needs to ensure that it fosters the development of clear competencies in its priority sectors, advances capacity building of actors refines an organized system of information exchange and stimulates ministerial coordination and professionalism (Michaelowa 2003). A.T. Kearney (2004) classifies a list of factors that pose a risk to the operations of firms or, as is in this case, bilateral and multilateral CDM project developers and promoters: institutional instability, government regulations, legislation and political disturbances are amongst those factors that are considered critical determinants of investor risk. Martina Jung (2005) grouped countries into clusters based on institutional CDM capacity, the investment climate and mitigation potential and operated on the premise that high values for all three would translate into greater attractiveness for CDM developers. Her analysis showed that a country like Brazil with a good institutional capacity, scope for substantial mitigation and welcoming investment scenario is very attractive for CDM projects.

Jeswani and Solis (2006) have found a link between the structure of the DNA and investor attractiveness through their comparative study of the CDM investment climate in Pakistan and Peru and have confirmed that national authorities that create fewer bureaucratic hindrances, decrease transaction costs and encourage faster approval processes attract more investors than other countries with similar financial attractiveness.

On the complementary side of things, the carbon market (CDM and emissions trading) has provided the additional regulatory structure needed for incentivizing private sector participation in projects that investors were previously wary of (Benecke 2008). CDM has helped increase the attractiveness for renewable energy projects by lowering economic and financial barriers to hosting clean energy programmes (Benecke 2008; La Rovere 2002). Renewable energy plants have high installation costs and a longer incubation period before returns on investment. Even though the operating costs for renewable energy technology are low the high initial investment turned off private sector participation (Soker 2007). With the financial incentives given through the trade of CERs and the tax breaks for renewable energy projects provided by the Brazilian government, cost related barriers have practically ceased to exist.

Finally, in terms of CDM investor attractiveness, the most important lure for investors is Brazil's potential for CDM projects across a wide sector of approved activities. This varied potential- is responsible for making it the third largest recipient of CDM investments. It has a sweeping sectoral scope ranging from renewable energy, landfill activities, N2O reductions, Swine generated waste removal and cogeneration activities, fossil fuel switch, energy cropping, sewage and water sector, energy efficiency, waste, reforestation, industrial processes and capture or redirection of fugitive emissions (Oliveira 2009; La Rovere 2011).

The Role of Regional and State Climate Policies in Brazil

This section explores the collaborative and sometimes, independent actions of national and regional players in furthering the agenda of climate mitigation in Brazil. This federal break-up of roles in Brazil is not a deliberately planned move in the Brazilian context but this is significant given that there is rising support for the idea that cities and states play an important role in climate policy. Regional governments along with transnational networks of sub-national governments (TNSG) are also getting increasing opportunities to interact with international climate governance systems (Betsill and Bulkeley 2007 and Setzer 2009). Indeed, Brazil's inclusive federal structure confers its governors with the power to influence national agendas and states like Amazonas and Sao Paulo which possess autonomous administrations, control planning sectors, transportation and energy sectors have evolved sound regional climate policies (Setzer 2009). In fact, Sao Paulo drafted an international climate law which sought to reform the current climate change regime.

Rival (2012) echoes Willems' (2003) sentiment for fostering intersectoral, multilevel coordination within the different levels of government to enhance climate institutions by suggesting that a creative use of Brazil's political structure that enables cooperation between different levels of its government could help build more robust legal and infrastructural apparatus for mitigation and conservation efforts.

In the absence of international political institutions with the capacity to handle local manifestations of climate change, local governments and their institutions pitch in with their own responses to climate change streamlined to their own requirements (da Costa Ferreira et al. 2011). In Brazil, local and state governments are responsible for the following sectors that are crucial for implementing climate change mitigation activities: finance, engineering and public construction, urban and local development, health and public hygiene and social urban policies (da Costa Ferreira et al. 2011: 9). The role played by big cities in policy framing is quite substantial because three-fourths of Brazil population lives in urban areas. Rural agrarian communities have been quick to respond to and adapt to climate change considering the vulnerability and sensitivity to changed weather patterns of the agricultural sector (da Costa Ferreira et al. 2011). However, urban areas show a longer response period especially in the absence of local or state laws and they require a greater inducement to embrace adaptive behaviours (da Costa Ferreira et al. 2011).

Brazil's 1988 federal constitution distributed responsibility amongst the federation, states and municipalities for the preservation and maintenance of forests, fauna and flora. It authorized states to legislate on environmental issues. Minas Gerais became the first Brazilian state to enact its own forestry regulation, the State Forestry Law, in 1991, which stipulated that all companies or organizational entities that consumed or commercialized forest products were to source at least 90% of the wood from planted forests or commercial plantations (Chomitz 1999). This explains why the first afforestation/reforestation CDM project the 'Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil' CDM project (earlier known as the Plantar project), which aimed at 100% use of plantations for industrial uses, was in the state of Minas Gerais. A bill passed by Minas Gerais also recognized the role of the CDM in supporting the use of renewable charcoal from dedicated plantations (SEMAD, 2007). CDM was also an important component of Sao Paulo's 2009 State Policy on Climate Change which aimed at reducing Sao Paulo's GHG emissions by 30% of 2005 levels by the year 2012. Section III, article 4, paragraph 22 of Sao Paulo's state policy also explicitly mentioned the CDM as a legitimate means of climate change mitigation and promotion of sustainable development goals. The policy also cited the objectives of the state policy as fostering projects, including CDM projects, to reduce emissions and lower greenhouse gases.

There are however, critics of this liberal federal setup who believe that Brazil's federal constitution gives competing rights to the union and the states to legislate on environmental affairs that are often the cause of conflicts and judicial disputes.De Moura and Jatoba (2007) are critical of this multi-tiered institutionalism that creates overlapping functions across the levels of the government and the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), Brazil's federal environmental agency.

Brazil's National Policies' Role in CDM and Emissions Trading

To begin with, this section explores Brazil's national government's role in promoting mitigation programmes. The most important national climate plan in Brazil is its National Plan on Climate Change (2007) which prioritizes the objective of integrating Brazilian public policies, essentially bringing together Brazilian institutions such as the Interministerial Commission on Global Climate Change, the Brazilian Forum on Climate Change, the State Fora on Climate Change and so on (UNCSD 2012). Brazil's National Climate Change Policy Law of 2009 pledged the voluntary goals of GHG emission reduction between 36.1% and 38.9% by 2020 (La Rovere2011). The main source of these emissions cuts are to come from curbing deforestation in the Amazon region followed by the reduction of emissions from the agricultural sector. Since financially feasible mitigation alternatives are available in plenty in the agricultural sector there isn't much of an incentive for investors to develop CDM projects in areas that already have cheap emission reduction solutions. This is because additionality is hard to prove in such a case, baseline scenarios are calculated at a higher rate and there are few CERs to be earned. Additionality is a crucial requirement for CDM registration which demands that a project result in 'emissions reductions in excess of what would have occurred under a business as usual scenario' (Pearson and Loong, 2003: 1). Therefore, activities like agroforestry schemes, intensive cattle raising, recovery of degraded pasture land and low tillage techniques are only included as marginal activities in CDM projects (La Rovere 2011).

The Role of Subnational Governments in Framing Climate Policy

Considering the very active role assumed by Brazilian states such as Sao Paulo, Amazonas and Minas Gerais in drafting their own climate change laws, this section examines the different policies, proposals and state laws drafted over the last few years. The two states with maximum supporting legislature supporting climate policies are Sao Paulo and Amazonas which is why the policies for these states are examined in detail. Sao Paulo's climate proposal is given special importance since it reflects the role of regional governments in asserting their stance in international politics; and therefore, has its own section. Following from the premise that CDM projects will be more likely in cases where there is governance and legal apparatus as well as scope for adequate returns on investments, these are the states that should ideally have a larger range of projects. For instance in a cross-factor analysis of sugar cogeneration projects in Brazil and India, Hultman et al. (2009) found that with other factors being held constant, what drives investment in CDM projects is the regional policy and regulatory regime; involvement of private sector intermediaries; activity of non-governmental actors; and capacity building activities and the implications of CDM regulatory decisions. In other words, if a state provides the incentives for developing the constituents for carbon markets, it will result in more CDM participation.

1. Sao Paulo's Proposal for the Creation of an Enhanced International Climate Agreement

The Sao Paulo Proposal for enhancing the international climate framework addresses the need for an improved climate agreement that doesn't require frequent renegotiations at the end of each commitment period as the Kyoto Protocol does at present (Haites et al. 2004). This is an example of an important regional knowledge centre (as represented by Sao Paulo) intervening to offer corrective solutions for the working of the international carbon market as represented by the Kyoto Protocol. The proposal addresses issues that are raised often by the developing south but aren't given institutional expression by the UNFCCC at present.

In principle, the Kyoto Protocol encourages the development and research of energy efficient technology and the kind of long term capital investments that can change the structure of energy use (UNFCCC 1997). However, the Protocol doesn't provide the framework required for these long term changes because at the end of each commitment period of five years (with the current period ending in 2012), nations are allowed to renegotiate their obligations based on their national interests and new scientific evidence (Haites et al. 2004). The dilemma faced by policymakers pushing for long term commitments is that states will agree to very lax emissions goals that do not 'interfere' in their project of development to make their commitments politically acceptable. [31] Renegotiating commitments also creates a lot of uncertainty regarding the stand of other countries. The Sao Paulo Proposal aims at establishing a long term framework with each country allowed minor changes in their commitments without going through the cost or uncertainty of completely renegotiating an international agreement (Haites et al. 2004). Such a policy can also give carbon markets a new lease of life.

The proposal subsumes other sectoral agreements as well, leading to one streamlined agreement. Among its recommendations are: developing countries adopting cuts only after developed nations take on concrete commitments including purchasing CDM credits so that the credit market remains viable; giving developing countries the opportunity to meaningfully engage with the carbon market and receiving funds for technology development; incentivize a path of low carbon dependency for developing nations; and, recognizing that developing nations have changing obligations depending on their development objectives (Haites et al. 2004).

Sao Paulo's Proposal also addresses the criticism that the abuse of the carbon market could help wealthy countries offset their entire reductions quota without actually making emissions cuts. It proposes to allocate a fixed number of CDM credits globally and for each country (Haites et al. 2004). After a developing nation reaches its allocation limit, it too

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[31] The perceived link between economic growth and emissions heavy energy intensive modes of development are responsible for the apprehension that developed countries have in promising generous emissions reductions targets. The low voluntary commitments promised by Brazil and India reflect this stance. Emerging economies also have a very optimistic projection of their future growth prospects, growth that is dependent on conventional energy sources as long as viable alternative sources aren't available.

must adopt national emissions cuts. This system will help check the overuse of the credit market by both the developing and the developed world.

2. The State of Amazonas

In 2007, Amazonas became the first Brazilian state to adopt a regional law on climate change known as the 'State Law on Climate Change, Environmental Conservation and Sustainable Development' (Rohter 2007). This law created a State System of Conservation Units (UCs), a state level unit of Brazil's conservation units which were established in 2000 as 'territorial areas and their associated environmental resources, including territorial waters, with relevant natural features, legally established by the Government, with conservation objectives and defined limits, under special administration, which apply appropriate protection safeguards (Medeiros et al. 2011:8). The Amazonas law made provisions for instituting seven state programmes: Bolsa Foresta (Forestry Exchange), Education about Climate Change, Environmental Monitoring, Environmental Protection, Exchange of Clean and Environmentally Responsible Technology, Training Public Organs and Private Institutions and Incentives to the Utilization of Clean and Less Greenhouse Gas-Emitting Alternative Energy (Amazonas Climate Change Law 3.135 2007). A special fund was created to finance these seven programmes along with GHG stabilization projects in different sectors that included energy, forestry, agro-industrial and agriculture. The law also sought to give tax benefits for inputs for biodiesel and energy generation from waste incineration amongst others, two activities that could easily be accommodated within the CDM framework (Amazonas Climate Change Law 3.135 2007). This is because the CDM allows waste handling and disposal and energy industries (including cogeneration and the production of biodiesels like ethanol) as legitimate CDM activities. Since waste disposal through incineration will undoubtedly lead to increased emissions, the installation of a CDM project for controlling fugitive emissions from fuels and production and consumption cycles would easily be a more environmentally optimal solution to waste disposal (UNFCCC 2012). The northern state of Amazonas is a site ripe for forestry related CDM projects like carbon sequestration and enhancement sinks. There are vast tracts of fallow land in this region, unfit for agricultural production or livestock rearing, making this region a perfect candidate for sequestration activities like silvicultural plantations and reforestation projects (Serroa da Motta 2002).

An interesting illustration of the complementary roles played between national policy and the flexible mechanisms in achieving sustainable mitigation is a certain provision regarding CDM that was made in the Amazonas Climate Change Law. In an example of a state stepping in to pave over perceived gaps in CDM with a strategy that's uniquely suited to it, the law sanctions the state to prioritize and assist in funding CDM projects--especially those related to avoided deforestation activities .[32]Avoided deforestation (AD), which refers to the prevention or reduction of forest loss in order to reduce emissions of global warming gases, is not recognized as a legitimate CDM project activity (Peskett et al. 2006). Amazonas' decision to include AD is supported by Fearnside (2001) and Serroa da Motta (2002) who consider it an ideal strategy for forest conservation because current reforestation practices in Brazil involve monoculture which has social and environmental risks associated with it. [33] Avoided deforestation helps in retaining biodiversity and endogenous flora and fauna, thus contributing to sustainability. On the other hand, the larger international community's reservations about adding AD to CDM activities has the effect of prompting Amazonas to take a cautious and measured approach in including an activity that could seriously impact social and livelihood issues and the rights of indigenous and marginalized people (Griffiths 2007). The irony is that while Brazil has opposed AD as a matter of national stance, its states have shown interest in implementing similar activities. Rapid expansion of AD could lead to violations of territorial rights, the exclusion of indigenous communities from forest lands, unfair contracts, overwhelming state and corporate control of forests, land conflicts, inadequate compensation of traditional land and so on (Griffiths 2007).

32 Avoided deforestation isn't allowed for a range of reasons: difficulties establishing baselines, preventing leakages, ensuring that the credits are permanent by making sure trees aren't cut down (refer to footnote 6), the unfair advantage countries with large forest resources would have in earning CERs from essentially 'doing nothing' and so on (Adapted from Peskett et al. 2006 and Antlov 2010).

[33] The development of forest plantations in Brazil has only started in 1967, in response to a federally subsidized reforestation program, enacted by the national government under law 5.106.

Since deforestation contributes to Brazil's emissions in a significant way, Brazil has been trying to meet the twin goals of preserving the Amazon rainforests by limiting and avoiding deforestation and utilizing it as a natural carbon sink while also enforcing reduction commitments which will give it international credibility (Seroa da Motta 2002). At present, conservation efforts in the Amazonas promote sustainable development by fostering an increased sense of ownership for the marginalized and indigenous populations of the region to and reinforcing their innate ethic of care (Rival 2012). The state of Amazonas has a conservation programme in place which is complemented by Brazil's National Fund for the Environment (FNMA). Amongst the FMNA's areas of focus are Forest Extension, Integrated Management of Protected Areas, Sustainable Amazon, Environmental Quality and Integrated Management of Solid Residues. Considering the overlap between FNMA's focus areas, Amazonas' priority sectors as per the Amazonas law on climate change and allowed activities under CDM, small CDM projects could easily be given funding in an area where they are otherwise scarce.

The CDM has already stimulated conservation efforts with projects such as AES Tietê which aim at conservation education and biodiversity efforts (AES Tiete PDD 2011). Thus, the FNMA could provide some of the seed capital for small scale CDM projects in often neglected parts of the Amazon that are related to its priority sectors.

3. The State of Sao Paulo

A scenario epitomizing CDM's cognizance of a previously unrecognized environmental problem is the profusion of waste handling and disposal CDM plants in the state of Sao Paulo—a region where waste disposal in poorer areas received scant regard (La Rovere 2002). This densely populated, heavily urbanized state has a large population that lives in unregulated slums which are often situated near landfills which give off noxious fumes. La

Rovere (2002) notes how the so called 'brown agenda'[34] which dealt with urban environmental problems such as the absence of sewage systems, lack of solid waste collection and proper disposal, air pollution, poor quality of water and so on went unrecognized in the link between development and the environment. Neither national, state or municipality governments promoted a sustainable development agenda that included this 'brown agenda'. After the Kyoto Protocol entered into force in 2005 there have been 87 CDM projects related to waste handling and disposal in urban areas.

These urban renewal CDM projects have important additional benefits as well (UNFCCC 2012). For instance, the Bandeirantes Landfill Gas to Energy Project was undertaken in Sao Paulo to manage the waste problem there (ICLEI 2009). This project is the world's largest gas recuperation programme in the world (UNFCCC 2006). Methane emissions from landfills constituting urban waste was turning into a health and climate risk with a potency 24 times that of CO2 (Bandeirantes PDD 2006). With a lack of regulations regarding the establishment of residential area in the vicinity of landfills, landfill toxicity is a major issue (Bandeirantes PDD 2006). The Bandeirantes project helped collect the landfill gases to be used in biogas plants and was estimated to prevent the release of atleast 7.4 million tons of CO2 into the atmosphere (Bandeirantes Validation Report 2007). The landfill was sealed over and planted with grass and a system to siphon off methane from the landfill was constructed. The project also succeeded in creating employment opportunities in the project area, generating additional revenue, producing clean energy and helping in technology acquisition and training (Bandeirantes Validation Report 2007). Public awareness increased and the carbon credits earned from this project were used for financing the Sao Paulo municipality's sustainable development projects (Bandeirantes Validation Report 2007).

[34] The 'brown agenda' is related to environmental issues that are experienced in urban areas rather than the more fashionable 'green agenda' which is limited to the protection of forests and fauna only. The media is responsible for disseminating this very skewed version of what constitutes environmental concerns.

Institutional, Governance and Regulatory Barriers to the CDM and Emissions Trading Mechanisms

This section examines the seven main kinds of institutional, governance and regulatory barriers that are faced while trying to implement CDM and emissions trading in Brazil.

1. Political and Interest Group Pressure

Forestry related CDM projects in Brazil have been conspicuous by their absence. This isn't entirely surprising considering that policies aimed at the reduction of deforestation in the developing world have not succeeded because of a lack of incentives, political compulsions or inadequate enforcement capacity This was seen in Brazil when it made controversial changes in 2011 to the 1965 forest code law resulting in significant increases in the rate of deforestation for the Amazons (Fearnside 2011, Fearnside 2001). The Code required Amazon landholders to maintain 80% of their land as forest reserves and in its original form the code was an important piece of legislation for regulating forestry activities. It introduced the concept of permanent preservation areas and legal reserves (Fearnside 2011). Under the law the transportation or storage of wood, firewood or charcoal originating from native forests and production of charcoal using fine quality native wood without authorization were viewed as criminal offenses. [35] The forest code has served as an adaptive mechanism over the last forty years, reflecting Brazil's changing priorities and conservation strategies as well as the (sometimes) detrimental effects of interest group pressure (Fearnside2011). The changing approach of the Brazilian government to forest preservation is reflected in the surprisingly low number of afforestation/reforestation CDM projects in recent years (Fernside 2011).

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[35] Brazilian environmental legislation (as defined by the National Forest Code, Law Number 4.771/1965, as well as in CONAMA Resolution 4/1985 and Resolution 302/2002) does not allow for management or conversion of Areas of Permanent Preservation. These laws provide a legal framework for forest maintenance and conservation (Project 3887 PDD, 2011).

The new laxness of the forest code arose due to the pressure of agro-businesses or ruralist groups that wanted more land for pasture and agriculture and leniency in dealing with violators of the previous versions of the act. These ruralist groups were also responsible for demands to do away with a host of environmental laws as well as governmental institutions that uphold the pro-environmental legislation (Maia-Neto 2012). The ruralist groups in opposition to these laws claim that their contraposition lies in the fact that these laws can impede food production and exacerbate rural poverty (Maia-Neto,2012). This is a claim that has been disputed by organizations such as the Brazilian Society for Scientific Advances which say that the legal protections provided for in the forest act are in resonance with Brazil's requirements to achieve ecological stability (Maia-Neto 2012).

2. Lax Law Enforcement

In spite of the slew of environmental laws being passed, the rates of compliance are rather low because there isn't a well established method of enforcement yet (Peterson et al. 2007). In CDM projects where there are elements of forestry (agriculture, reclamation of degraded lands, preservation, reforestation and so on) compliance is quite high because of the lengthy and comprehensive verification stage that CDM requires before a project can demonstrate additionalities and is validated.[36] In such cases compliance rates are significantly higher. This laxness in compliance is also attributed to inadequate structuring in the bodies mandated with environmental regulations and compliance (Maia-Neto 2012).

3. Markets and environmental regulation

The Conference of Parties and the CDM Executive Board are the international regulatory bodies that govern the processes of registration, approval and development of CDM projects under common criteria. Even though there are Designated National Authorities for each participant nation, the overall structure within which CDM and trading takes place is pretty similar. Brazil's DNA focuses on ensuring the environmental integrity of CDM projects.

[36] There are a large number of CDM projects with *elements* of forestry though they aren't explicitly categorized under the conventional CDM activities of afforestation/reforestation.

The DNA can help with the implementation of the CDM project cycle which refers to the different stages a project activity must undergo before it may be issued with CERs. The CIMGC has a reputation for doing a thorough validation over 4 to 6 months to ensure the environmental integrity of the CDM project (Friberg 2007). These stages include the Conception of the Project Idea, through to Developing the Project Design Document, Validation, Registration, Monitoring and Verification, and finally the CER Issuance (UNFCCC 1997).

4. Financial Policies as Barriers to CDM and Emissions Trading

The CDM is essentially a the architecture for a market which trades in CERsand as with all markets investors in CDM are also quite risk averse. However, Brazil's carbon market is quite underdeveloped at present and will continue to grow at a slow rate in the absence of regulatory mechanisms to organize the flow of carbon trading instruments (Cavalcanti2012). Brazil doesn't have a national market at present to facilitate carbon trading but there are efforts to create a carbon market on the lines of the European market (Shankleman 2012). There is also a common perception that Brazil lacks a long-term debt market, as the only supplier of long-term loans is BNDES, the Brazilian National Development Bank (Castro and Michaelowa 2007). The interest rates for borrowing are considered high enough to be a barrier for many CDM project developers. The high interest rates make borrowing an expensive option which prevents smaller CDM projects from being registered as the funding needs to come from the investor's own revenue or equity (Castro and Michaelowa 2007). One of the requirements for a business to run is supportive legislation, a concept that extends to the legal framework within which the markets can operate (Cavalcanti 2012). There is a lack of specific rules governing trading which adds to the uncertainty in the market. There is plenty of scope for interpretation, without the definition of boundaries or doctrinal understanding which can prevent two parties from interpreting the rules of the market in opposing ways. For instance, there was regulatory and definitional uncertainty with CERs in Brazil which could send the CERs into financial and governance limbo (Cavalcanti 2012). When structuring the first investment fund for CERs in Brazil, it was recommended that CERs not be treated as securities (Cavalcanti 2012).

Without the existence of guidelines governing the trading of CERs, a necessary requirement considering the bullish quality of CERs as tradable market instruments, there is a tendency towards stagnation of the market (Cavalcanti 2012). A Brazilian carbon inventory can help create a demand for credits by providing well organized information (Shankleman2012). The government institutions have remained silent on the nature of CERs and whether they could be considered tradable by mutual funds or be in the credit or equity market which added to the confusion over the CERs as financial instruments. Neither the Brazilian Securities Commission nor the Brazilian central bank has issued regulatory instructions for carbon markets and even the Internal Revenue Service of Brazil has remained vague on the taxation liability.

5. Asymmetrical Distribution of CDM Projects

CDM projects have a tendency to be concentrated in the more developed regions of the south and south eastern parts of Brazil (UNDP2003). The southern states and economic hubs of Sao Paulo, Minas Gerais and Rio Grande do Sul, Santa Catarina and Mato Grosso account for approximately 64% of the all the CDM projects (UNEP Risoe Centre 2008). Therefore, claims that CDM can reduce inequality, encourage development and alleviate poverty should be made cautiously considering that the poorest states often account for a negligible number of projects. The asymmetrical distribution of CDM projects across more developed and less developed regions within countries and between countries has been observed globally (Cosbey et al. 2005; Americano, 2008, De Lopez et al. 2009). This is despite Decision 17/CP.7 of the Marrakesh Accords underlining the case for an 'equitable geographic distribution of clean development mechanism project activities at regional and sub regional levels' (UNFCCC 2001). The reason cited behind the high number of projects in this region range from synchronicity with preferred sectors and potential, meeting capacity requirements, access to underlying finance, infrastructural support, and procedural ease (based on Elkhamlichi, 2009). The concentration of CDM projects in these states bears out one part of the hypothesis which is that institutional and infrastructural robustness tends to attract CDM project developers. In Sao Paulo, three environmental secretaries have been committed to moving forward climate negotiations and hasten the passage of CDM projects. Renewable energy sources such sugarcane products like bagasse and ethanol, urban solids and wastes in large landfills, hydroelectricity, solar and wind resources as well as greater efficiency gains in energy production/generation and well connected transportation-distribution networks are available in the urbanised south and south east which contribute to the greater concentration of CDM projects here (UNIDO 2003).

With most large industries being located in the south and south eastern parts of Brazil, there are a large number of CDM projects located here because of the greater gains in additionality that can be shown for projects. For instance, end-of-pipe CDM projects can earn a large number of CERs in a short amount of time and 'benefit' from the large effluents in industrial areas. Projects focusing on energy efficiency, process change, fuel substitution can be easily set up there because of the high energy consumption and GHG emissions in those industries-- factors that can easily be mitigated through conveniently produced renewable energy sources or more efficient technology. For instance, combined heat and power production in the sugar mills can bring down emissions (UNIDO 2003). Nationally, Brazil needs to enhance its CDM related capacity building. With most major universities concentrated in one region and not enough specialists there is a narrow pool of CDM experts who tend to specialize in optimizing very region specific CDM projects. Therefore, Brazil needs to build training hubs for researchers and governmental officials and networks for capacity building (UNIDO 2003).

To address the gulf between the poorest and emerging countries in terms of attracting projects, the United Nations Climate Change Secretariat announced the launch of a new loan scheme in 2012 to encourage CDM projects in the least developed countries of the world (UNFCCC2012). The loan covers the lengthy and expensive CDM cycle running from the project design documentation stage to the final stage that requires the verification of CERs. However, considering the wealth of literature citing non-financial barriers to CDM implementation, it is doubtful that financing alone can encourage the spread and access of CDM projects (Ellis and Kamel 2007).

6. State Intervention and Financial Policy Barriers

State led market interventions are another form of government regulation and this form of Keynesian intervention gets institutionalized when it is used in the course of normal government policy. For instance, the governments of oil producing nations commonly affect the level of consumption and production of fossil fuels through measures that influence its demand and supply While Brazil has recently introduced fuel subsidies, it has also implemented various market based incentives for renewable energy over the years. These regulatory actions are usually in the form of market interventions that affect either costs or prices like subsidies, tax breaks, assuming partial risk, subsidizing the use of government-supplied goods or assets or fixing minimum support prices (La Rovere 2002). These actions have the intended effect of incentivizing production, encouraging more players or even the entry of players (or in this case, CDM projects in oft neglected sectors or regions) and increasing consumer receptivity to those products. The government decides on what economic variables they want to subsidize depending on what side of the demand-supply curve it is interested in tweaking. For increasing consumer demand for renewable energy or perhaps energy efficient hybrid cars Brazil would choose to subsidize consumer prices and it could reduce or eliminate Value Added Taxes. In the field of renewable energy Brazil has incentivized production by subsidizing production, intermediate inputs and lowering the cost of entry (though this also makes the price of renewable energy more competitive).

Measures like the 2011 tax subsidies on fuel have made conventional fuel sources cheaper and more in demand by consumers thus lowering incentives to invest in renewable energy sources. This motivates project developers to invest in more end-of-pipe fixes. From the perspective of public policy, removing fuel subsidies allows a more efficient reallocation of energy resources and brings gains in consumer welfare by reducing the level of carbon particulate matter in the air (Burniaux and Chateau 2011). It eliminates the unfair advantage that producers of fossil fuels have and draw in investors in renewable energy (Soker 2007). In 2009 leaders at the G20 meet committed to 'rationalize and phase out… inefficient fossil fuel subsidies that encourage wasteful consumption' (Burniaux and Chateau 2011). This commitment was made on the basis of a study that showed removing fossil fuel subsidies in a number of non-OECD countries could reduce world Greenhouse Gas (GHG) emissions by 10% in 2050 (OECD 2009).

As far as the carbon market is concerned, state mandated minimum support prices for carbon credits can help give a boost to the market that has witnessed falling CER prices. Governmental interference in the prices of Certified Emissions Reductions by fixing minimum prices has also been a barrier to free market forces (Castro and Michaelowa 2007).

Economic pressures within the European Union has meant that demand for carbon credits has fallen in the world's premier carbon market the European Union's Emissions Trading Scheme (EU ETS) (Pretorius, 2012). Many of the CDM projects had taken off in response to the generous 15 Euro prices per CER in the mid 2000s which plummeted to as low as 3 Euros in 2012 but there have been demands for setting minimum prices with project developers already having put in massive investments in CDM projects. The case for state intervention in fixing support prices is strong since if the price of CERs remains low (any level below 7 Euros), the penalizing mechanism that emissions trading is meant to play will be too weak to encourage emissions reductions and investments in green technology (Pretorius, 2012). Brazil shouldn't feel too much of the pressure from the European Markets and should experience a delinking with prices in the EU ETS because of its efforts to create its own carbon market (Shankleman 2012). Brazilian economists believe that a cap-and-trade scheme is the most important mechanism to curb industries and deforestation--the chief source of Brazil's emissions (Shankleman 2012).

Eliminating protectionism and the state's monopoly over energy resources and giving access to distribution networks and electricity grids will give small producers the opportunity to sell renewable electricity at competitive rates (Soker 2007). Brazil requires a stable taxation system that doesn't penalize or discriminate external finance which is of vital importance considering the multilateral and bilateral sources of CDM funding.

7. Other Barriers and Factors affecting Investment

The low prioritization of certain types of CDM projects (which may not figure highly on the government's agenda) also hampers the timely approval of CDM projects, driving up costs and dampening investor confidence (Ellis and Kamel 2007). Ellis and Kamel (2007) also cite international barriers in the form of constraints on which projects are eligible under CDM and whether there is available guidance to smoothly proceed with certain projects such as carbon capture and storage. If needed there should be sector specific reforms to give an impetus to programmes in those areas.

Analysis of Major Institutional, Governance and Regulatory Risks to CDM Projects

This section briefly covers the major risks that CDM projects can face in general or in Brazil specifically.

1. Risks Related to Post- Project Development Stages

This may be understood as the after-sales support stage. Domestically, there have been important changes in Brazil in the last few years that have encouraged the development of renewable energy and energy switch CDM projects such as allowing energy generated by CDM projects to be sold to the regional or national energy grid. Brazil's national electricity supplier, Electrobras has been buying electricity through CDM projects for a while. The Agua Doce Wind Power Generation Project supplied electricity to one of Brazil's regional grids throuh the 'Sistema de Medicao de Energia' or the Energy Measurement System which is installed by Electrobras at each of the CDM project plants (Monitoring Report, Ecoenergy Brasil, 2008). This sale and transfer of energy is regulated through a clear set of rules by a Power Purchase Agreement under the parameters set out by Brazil's electricity system manager, the Operador Nacional do Sistema(Ecoenergy Brasil, 2008). This serves as an important supplementary source of income for project types that are otherwise considered too lengthy in operation and expensive to set up.

2. Risks related to Various CDM Project Stages

CDM risks lie mainly at the pre-registration stage, verification stage and CER claims stage (Baker and Mckenzie 2010). The pre-registration stage requires a lengthy and expensive process of creating a validation report based on extensive field research (as provided for under paragraph 40 (f) of the CDM modalities and Procedures of the UNFCCC 2006). This includes the Project Design Document (PDD), the written approval of the host country (which comes authorized through the DNA provided its terms are met), and a response to any of the public comments received by the Designated Operational Entity (those who actually run the programme)[37]. The Project could fail to be successfully validated by the Designated Operational Entity (DOE), it could fail to receive the host country's Letter of Approval (for not meeting the country's CDM goals like sustainability) or rejection of the project by the CDM Executive Board (Cole and Liverman 2011). Of course the responsibility for using the correct methodology to calculate additionalities and valid baselines lies with the project investors.

Risks associated with the second stage of validation can be minimized by the host country by adopting clear and comprehensive guidelines on what it considers to be ideal CDM projects. To do this, the DNA can develop a portfolio of diverse high quality CDM projects that meet the requirements of the host country as well as the investors (Jeswani and Solis 2006). Until recently Brazil's means of measuring sustainability criteria for CDM projects was considered as job creation and developing working conditions; local environmental sustainability; income distribution effects, technological development and capacity building; and factors promoting regional integration and sectoral linkages (Cole and Liverman 2011). These factors were based on the AnnexIII factors that were to be submitted to Brazil's DNA, the Interministerial Commission on Global Climate Change, to get a letter of approval. These specifications are based on 40(a) Compliance, a section in the Marrakesh Declaration that specifies the host country's DNA is to issue a Letter of Approval certifying

[37] These public comments are made by the various parties involved, stakeholders (such as communities in the project areas), NGOs and UNFCCC accredited observers. All new projects must be submitted for public comments for a period of 30 days at the validation stage in accordance with paragraph 40 (b) and 40 (c) of the CDM modalities and procedures and the procedure on public availability of the CDM-PDD agreed by the CDM Board (UNFCCC 2006).

that the proposed Clean Development Mechanism project activity assists the host country in achieving sustainable development (Marrakesh Declaration 2001).

There are also risks related to the final stage of issuing CERs, related to the titles of CERs. This happens in cases where there is uncertainty regarding which party owns the CERs generated by a project. Since host countries have different regulations and legal stands (or none at all) on ownership claims to CERs there is a possibility of conflicting claims which may deny one party the right to sell the CERs or may make them unsellable. As noted by Baker and Mckenzie (2004), these rival claims may come from the host country itself in cases where the resources required, such as renewable energy sources, are vested in the state. There are also non-CDM approvals involved where there are wholly foreign investor companies and the host country's laws don't permit 100% foreign investment or where the approval process is difficult. Changes in the host country's fiscal and environmental laws may also affect the viability of operating a project.

Overall, CDM investment does depend a lot on the investment forecast and perceptions about a country's ability to generate returns on investment. Brazil's economic outlook is quite positive and it's conduciveness to investment is shown through its willingness to make interest rate cuts and tax cuts even in the midst of inflationary times to encourage businesses (UNIDO 2003; Brazil Investor Guide 2012). While Brazil's investment in infrastructure as a percentage share in GDP has been steadily declining since the 1970s, it is still more robust in the eastern and south eastern parts of the country which could explain why there is a larger proportion of CDM projects in those regions.

3. Political Risks

While the investment outlook shows growth in Brazil's credit sectors (an excellent sign for funding for CDM projects) and Foreign Direct Investment, concern has been shown on behalf of political paralysis, bureaucracy, an inefficient tax system and deficient infrastructure which are factors that make new project investors wary (Brazil Investor Guide

2012). The political environment is also a factor that is significant in factoring in risk analyses (Baker and Mckenzie 2010). Investors shy away during politically uncertain times or at the initial period of a new government because it is impossible to predict long business trends without political stability given the fiscal and financial decisions that lie with the government (Bremmer 2009). This could be a politically complicated period for investors in the Brazilian carbon market since there is a fair bit of uncertainty in the direction Dilma Rousseff is expected to take politically and economically. However, Rousseff's government has brought in several positive changes in terms of structural reforms and long term policies that are considered conducive for new projects. Rousseff has taken a stern stand against corruption and patronage and fired several ministers in quick succession in response to allegations of corruption against them. Since corruption is cited as a CDM barrier this is a good step forward (Klapper et al. 2006). Brazil is also moving towards more transparency in government records and a freedom of information bill was signed in October 2011 which came into effect in May 2012. The bill empowers Brazilian citizens to learn how Brazil's tax money is spent and the exact sources of the government's funds (Salas 2012). Rousseff's role as a co-leader of the Open Government Partnership together with US President Obama has encouraged Brazil to embrace other transparency commitments such as encouraging public participation, freeing access to new technological innovation for accountability and introducing rigorous standards of professional accountability in the government (Salas 2012).

This kind of openness is vital to investor confidence and reduces the chances of corrupt below-the-radar deals that foreign investors are often subjected to.

Conclusion

The institutions and systems of governance created by Kyoto Protocol's flexible mechanisms of CDM and emissions trading have enhanced Brazil's capacity to handle climate change (Fuhr and Lederer 2009). A new niche of climate specialists, private developers and entrepreneurs, financial experts and consultants has emerged in Brazil. In fact, in the absence of the flexible mechanisms it is quite possible that Brazil's carbon governance community wouldn't even exist (Fuhr and Lederer 2009).

It is important for Brazil to continue to create and (improve upon) institutions and practices that endure even after the first commitment period of the Kyoto Protocol ends. Transnational relations between national and regional governments and the international community have created an unparalleled number of linkages spurred by the Kyoto Protocol and it is imperative that Brazil take advantage of them to fully exploit these opportunities (Friberg 2007). Where state institutions are weak, the government's role in implementing climate oriented policies may be compromised (Fuhr and Lederer 2009). Brazil has been fortunate that many of its states have drawn out a long-term plan to take on mitigation goals. Even though the flexible mechanisms are market oriented, without the regulatory role of the different levels of the government these mechanisms would have been wont to succeed.

The bottom-line is that Brazil owes its admirable success with Kyoto Protocol's project-based carbon financing mechanisms, the CDM and emissions trading, to the fact that it meets three vital requirements—a well entrenched institutional and regulatory capacity, a healthy investment climate and a high potential for GHG mitigation (Boyd et al. 2009, Thornley et al. 2011).

CHAPTER III

Brazil and the Clean Development Mechanism

Introduction

The Clean Development Mechanism, the first global environmental investment and credit scheme, is a project-based carbon financing system that helps pay for low-carbon or carbon mitigative development projects in developing nations (Thornley et al. 2011). This mitigation is achieved through projects that remove or reduce GHG emissions by either altering the energy mix in favour of renewable sources of energy, investing in clean technology or through the prudent management of forest and energy resources (Vargas 2002). CDM projects are hosted in developing countries that are not a part of the Kyoto Protocol's list of nations with emission reduction obligations. The projects are either financed by or supported by annex I countries. Developing countries are the focus of this mechanism because abatement costs for emissions reductions in these nations are lower by as much as 50% to 75% of the costs incurred by industrialized nations and this, therefore, decreases aggregate global mitigation costs (Repetto 2001)[38]. Annex I countries can buy the resulting CERs to comply with their own emissions reductions targets at a lower cost and the benefit for developing countries comes in the form of capital investments, the transfer of clean technologies and the promotion of sustainable development projects (Thornley et al. 2011).

The revenue generation for mature CDM host countries can be quite substantial and Brazil accounts for the fourth highest share of issued CERs which accounts for 7.3% of the total with average annual GHG reductions worth more than the value of 69 million CERs for the

[38] Abatement costs are lower for developing countries because of the lower relative costs of inputs. Also, since developing countries are at an earlier stage of industrial development (the main culprit in terms of GHG emissions), they are not slaves to path dependence and can adopt alternative development paths.

year 2012 (UNEP Risoe 2012). The countries with the highest issued CERs are China (59.8%), followed by India (14.9%) and South Korea (9.3%). CDM projects have also represented significant investments in Brazil by leveraging additional capital and direct capital investments (Thornley et al. 2011). For instance, Brazil attracted $7.6 billion in clean energy investments in 2010 which increased to $8 billion in 2011, or 15% of global clean energy finance (The World Bank 2011; Globe-Net 2012). The CDM was officially launched in 2001 with the first project—Brazil's 'NovaGerar Landfill Gas to Energy Project' in the state of Rio de Janeiro—being launched in 2004. Over the next few years new rules were adopted for additional categories of CDM projects[39] such as small scale CDM projects in 2002, afforestation and reforestation projects in 2003 and small-scale afforestation and reforestation projects in 2004 (UNFCCC 2008).

CDM employs three strategies for reducing emissions—abatement, avoidance and removal. The first strategy is *abatement* and this can be affordably realized through end-of-pipe fixes similar to N2O abatement programmes like the Petrobras FAFEN-BA Nitrous Oxide Abatement Project in Bahia, or energy efficiency projects like the Guaíra bagasse cogeneration efficiency project in Sao Paulo and the Alto Alegre Energy Efficiency Project in Parana. End-use energy efficiency projects have a high potential for achieving sustainable, low cost mitigation (Matschoss 2007). However, these energy efficiency projects are not as well represented in the CDM portfolio in Brazil because of their lower earnings of CERs since a significant amount of emissions savings accruing from these projects are often experienced out of the project site and over a more staggered period of time (Matschoss 2007). The second strategy is the *avoidance* of GHG emissions and this is achieved through energy switch programmes, for instance, the use of biogas generated from landfill sites rather than the use of fossil fuels for meeting energy requirements. Two examples of avoidance projects are the COTRIBÁ Swine Waste Management System Project in Rio Grande do Sul and the BRASCARBON Methane Recovery Project in Minas Gerais which are methane avoidance projects (COTRIBÁ Swine Waste Management

[39] These were categories of CDM projects not included in the original version of the Kyoto Protocol.

System Project PDD 2012; BRASCARBON Methane Recovery Project PDD)[40]. The third strategy is known as *removals* and this is accomplished through afforestation and reforestation projects which help create carbon sinks or assist in carbon sequestration. [41] This is a form of compensated reductions which allows the measurement of emissions reductions in a region-wide or nation-wide scale rather than just being limited to the confines of the project area (Boyd et al. 2009). Brazil has not implemented any carbon sink and sequestration projects under the CDM framework though there are instances where some CDM projects do offer additionalities in the form of carbon sinks.

CDM: An Ideal Mitigation Mechanism for Brazil

CDM's importance as a mitigation mechanism can be attributed to six main factors: its sophisticated yet flexible regulatory structure; its institutional robustness; its promotion of capacity building in the host country; its ability to attract capital to assist countries in making the switch to an economy run on an energy efficient, non-carbon intensive model; a formalized system for technology transfer; and income redistribution effects— all of which are factors that make the CDM a very attractive tool for developing nations to achieve their mitigation goals. CDM projects also have positive impacts on human capital formation, employment opportunities, biodiversity protection and reducing inequality and so on. In Brazil's case, CDM has been a complementary force that has integrated with Brazil's national clean energy programmes.

Of all the factors contributing to CDM's success, it is its regulatory structure that should be credited with giving it the flexibility to be accepted as a viable tool for sustainable GHG mitigation. Nedergaard and Stehr (2008) illustrated the three types of regulatory regimes in international policymaking and the context that best fit CDM: the *stick style regulatory system* characterized by a command and control instinct, the *carrot style regulatory system* characterized by mostly economic incentives and the *sermon style regulatory system* which is characterized by a combination of the dissemination of information and the inducement to

[40] As explained in Chapter 4, these landfill projects are being actively promoted by Brazilian local governments because their CER earnings can offset governance costs.
[41] While sink activities weren't included in the initial iterations of the Kyoto Protocol, its inclusion was allowed in the sixth Conference of Parties to the Kyoto Protocol in 2001.

act. Part of the CDM's success is attributable to the 'carrot style' of regulation it follows which is typified by a coherent structures of incentives; voluntary and calculated choices by actors based on incentive structures; and the use of personal utility functions and knowledge which helps customize the CDM experience to each country's mitigation context (Nedergaard and Stehr 2008: 10). However, CDM's regulatory success is contingent upon the support given to it by the host country's institutions and in Brazil's case, its regulatory approach, which doesn't see very stringent post-project monitoring from its DNA, may allow project developers to meet project requirements with their business-as-usual activities without making any meaningful mitigation contributions (Boyd et al. 2009).

As far as capacity building is concerned, CDM facilitates institutional, human and systemic capacity building in the host country (Nondek and Niederberger 2005).[42] The concept of capacity building includes the conceptual understanding of all actors and stakeholders, institutional prerequisites, the extent of involvement and maturity of strategy/policy formulations (Nondek and Niederberger 2005: 8). The effects of these capacity building exercises are permanent as they signify a systemic change and allow the benefits of CDM projects to be experienced beyond the periphery of the project areas.

The CDM has been a complementary mechanism to Brazil's early efforts at enshrining its commitment to green energy within its legislation and through the creation of institutions. In 1974, Brazil implemented PRO-ALCOOL, its National Alcohol Fuel Programme to increase the production of ethanol to be used as a substitute for gasoline (UNIDO 2003).[43] Then, in 1985 Brazil inaugurated a programme to reduce transmission and distribution losses and promote efficient use of energy which was named the National Electricity Conservation Programme (PROCEL). These two programmes led to a significant reduction in GHG emissions and also laid the foundation for Brazil's energy policy and its receptiveness to an international level policy solution for climate change (La Rovere 2002). Promoting and

[42] Capacity building is a two-way street. Nondek and Niederberger (2005) observed that countries which are successful with fulfilling the requirements of capacity building are also the ones more likely to have positive CDM experiences. Brazil is not included in the Nondek and Niederberger study.

[43] The Programme was aimed at producing both anhydrous ethanol to be blended with gasoline and pure hydrated ethanol for use in vehicles running on this new fuel.

integrating CDM into Brazil's national economic and energy plans has worked as a confidence building measure by signalling to investors and project developers the government's commitment to carbon markets (Soker 2007). This is because ambitious targets for expanding renewable forms of energy increase CDM participation even when there is a lack of policy clarity.

The Paradox of Brazil's Energy Mix

One of CDM's primary objectives is to encourage the adoption of clean energy but considering Brazil's excellent track record with renewable energy, on the surface at least, CDM appears to be a bit redundant in the Brazilian context. However, in spite of Brazil's admirable consistency in promoting clean energy as a part of national policy, future gains in mitigation can be viably realized only through CDM which is what this section will demonstrate.

Brazil is the second largest producer of hydroelectricity in the world with a share of 84% in its total energy production even though oil accounts for the greatest share in energy consumption at 40% (Enerdata 2009). Biomass accounts for an additional 5% of energy generated in Brazil (Enerdata 2009). This self reliance and high dependence on renewable energy is in response to the oil shocks of 1973 and 1979-80 which completely caught Brazil off guard (La Rovere et al. 2008). To counter its massive reliance on imported oil which drove up foreign exchange expenditure, Brazil launched a successful renewable energy programme which concentrated on hydropower. This government supported policy was responsible for building Brazil's enviable expertise with hydroelectricity and ethanol bio-fuels.

Considering the scenario as described above, CDM's effect on Brazil's adoption of renewable energy sources would appear to be exaggerated or negligible at best. However, there are four primary reasons the CDM is not redundant and is indeed a valuable tool for enhancing Brazil's renewable energy programme:

1. The first reason is that in spite of the success (in terms of production and share of the energy mix) of Brazil's national renewable energy strategy there were negative ecological and social impacts at regional and local levels because of high costs and constrained public budgets (La Rovere et al. 2008).
2. Secondly, the expansion of renewable energy (as exemplified by the mature technology of hydroelectricity in the Brazilian context) represented diminishing marginal returns in Brazil. Akin to Tainter's theory, a more complex range of inputs such as technology, human resources and finances would be required to make marginal improvements over existing project designs[44]. Therefore, the investments required would become unsustainable after reaching a certain threshold (Alexander 2012: 2). The revival of interest in clean energy because of CDM has galvanized the development of renewable technologies, bringing down costs by enabling economies of scale (Wustenhagen and Menichetti 2012).
3. The third reason is that CDM has mechanisms conducting checks and balances that ensure environmental and developmental sustainability. Despite the vital importance of renewable energy to Brazil's clean energy matrix, all hydroelectricity installations are not environmentally friendly. If a hydroelectric plant is built in an environmentally fragile ecosystem or requires wide swathes of forests to be destroyed leading to the displacement of human and other organic populations, the plant will result in unsustainable practices and even more emissions through deforestation. An instance of unsustainable renewable energy is the Brazilian government's recent proposal to build several hydropower plants in the Tapajos river basin in the Amazon which will release 152 million tonnes of carbon dioxide and its equivalents and is equal to 15% of Brazil's voluntary emissions reductions that it had announced in 2009 (Araujo and Barreto 2010). These GHG emissions are due to the deforestation of about 1050 square kilometres of virgin forests and national

[44] Though Tainter's theory can be approximated to: the increase of complexity 'when human beings set out to solve the problems with which they are confronted' leading to diminishing marginal returns, this is a result that can be extended to the greater range of inputs and effort required when a resource is to be exploited beyond a readily accessible point (Alexander 2012: 2). Offshore oil reserves pose a similar question to developers—while drilling deeper will give developers access to rich reserves, the (current state) of technology will render the effort economically unsustainable.

reserves in the Tapajos region which is certain to result in a loss of biodiversity in the region (Araujo and Barreto 2010).

4. Finally, there were few technological innovations in the last two decades and the trend towards privatization of energy in the latter part of the nineties meant that private sectors were averse to spending the huge amounts needed for expansion and increasingly turned towards conventional energy (La Rovere et al. 2008). Structural adjustment policies opening up Brazil to foreign investment also took the sheen off renewable energy projects which required expensive infrastructural support and were therefore, low on the priority list in terms of foreign investment.

Since the last decade, the ascendance of CDM has helped appease the reservations of foreign capital towards renewable energy sources which explains the high number of CDM projects with bilateral or multilateral foreign partners in Brazil. Economic incentives and cost-reprieves have not just been catalysts for investors but also for host countries. A host country is more likely to be supportive of CDM if the overall costs of CDM—in terms of initial capacity building and policy development costs—are outweighed by the benefits of CDM—in terms of sustainable development benefits and mitigation effects (Nondek and Niederberger 2005). In Brazil's context at least, CDM's resounding success is proof enough that the status quo was not enough.

The CDM Project Cycle

There are seven steps in the CDM project cycle: the project design, national approval, validation, registration, monitoring, verification, and CER issuance (UNFCCC 2012). At the project design stage, project participants prepare the project design document (PDD) which involves using UNFCCC approved emissions baseline scenarios and demonstrating additionality. [45]At the second stage, the project participant secures a letter of approval from

45'The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity' (3/CMP.1, Annex, paragraph 44).If the PDD uses a new baseline or monitoring methodology, it must be submitted through the designated operational entity to the CDM Executive board for review and approval (UNFCCC, 1997).

the host party. In the case of projects hosted in Brazil, the Inter-Ministerial Commission of Climate Change (CIMGC), its Designated National Authority (DNA), is responsible for submitting a paper to the CDM Executive Board declaring that Brazil has ratified the Kyoto Protocol, its participation in voluntary and a statement of the parties that the CDM project contributes to sustainable development (CDM Executive Board, Annex 6). The third stage is validation which requires a designated operational entity (DOE) to validate the PDD. This validation is done against the modalities and procedures set out in the CDM handbook and the special requirements of the host country (UNFCCC 1997). The Designated Operational Entity acts an intermediary between the project owner and the UNFCCC (Patel 2006).

The fifth stage is the registration which is the formal recognition and approval of a project as a legitimate CDM project activity. This involves subjecting the proposed project to a completeness check by the CDM Secretariat and vetting by the CDM Secretariat and CDM Executive Board (UNFCCC 2012). Every now and then if a review is sought either by one of the parties or three members of the CDM Executive Board, then the project undergoes a review. The next stage is monitoring. The sixth stage is verification where the DOE again plays a role to ensure that the claimed amount of emissions reductions took place according to the approved monitoring plan. There are two stages in the verification process—verification and certification. Verification is an independent review by the DOE to make an ex post determination that reductions in GHG emissions are indeed a result of the CDM project. Certification symbolizes an assurance by the DOE that the specified period under review yielded the emissions reductions as claimed by the project operator and verified by the DOE. Finally, the last stage in the project cycle concludes with the issuance of CERs by the Executive Board (UNFCCC 2012).

To meet eligibility requirements to qualify as a CDM project, GHG emission reductions projects to be hosted in Brazil must meet the following requirements (Adapted from Earth Negotiations Bulletin 2001):
The approval of Brazil and the CIMGC must be sought; participation must be voluntary, it should meet the sustainable development requirements as laid down by the CIMGC, it must

demonstrate additionality and acquire all environmental clearances; it must submit an environmental impact assessment report if the project claims significant environmental additionalities; it must account for the problem of leakage which is the GHG emissions that may occur outside the project boundary (this ensures that GHG emissions are notmerely displaced but actually contribute to the net GHG reductions in Brazil); the project must include the participation of all stakeholders and their opinions should be taken into consideration; the CDM projects should not have negative auxiliary impacts on the local environment, projects should be related to approved sectors of the Kyoto Protocol's annex A and should be related to the mitigation of those gases that are listed under annex A.[46]

Other than Brazil's DNA, the CIMGC, there are more than 50 CDM project consultant companies overseeing the development of projects in Brazil. Brazil also has eight Designated Operational Entities (DOEs) authorized to validate and verify CDM projects.

The Evolution of CDM Project Activities

This section briefly covers the CDM's adaptation to the special requirements of smaller projects geared towards increasing the extent and quality of CDM's penetration in project areas that would otherwise be neglected.

1. Small- Scale CDM Project Activities

In its earlier *avatar*, CDM showed a marked bias towards large-scale projects which require substantial investments in time and money even before the operational stage. A recognition of the potential role of small scale projects in GHG mitigation led to the formulation of a new category of CDM projects with simplified rules contained under UNFCCC decision 4/CMP.1, Annex II (Frondizi 2009). The procedures and modalities enabling small scale CDM projects (CDM-SSC) were framed at the eighth Conference of Parties at New Delhi in 2002. The approval of such projects was contingent on their falling within either one of three categories (Frondizi 2009):

- Renewable energy projects up to a maximum capacity of 15 MW.

[46] Annex A to the Kyoto Protocol lists the greenhouse gases and emissions sources that must be mitigated or that must not be emitted beyond a certain threshold by Annex I Parties to the Kyoto Protocol.

- Energy efficiency improvement projects
- Other project activities that could result in emissions up to 60,000 metric tonnes of carbon dioxide equivalent per year.

The Sao Joao hydro power plant is a small hydroelectric CDM plant which has carried forward the legacy of small hydro plants promoted by the Brazilian government since 1984. The benefit of these small scale plants was to provide energy in remote areas of Brazil, emphasise local community development by decreasing the consumption of oil, the promotion of rural development and the advancement of local technology (Sao Joao hydro power plant PDD 2007: 2).

Small scale hydropower plants allow local distributed power generation as opposed to large scale business-as-usual projects. They also have shorter construction periods and are more reliable sources of power distribution (Brascan Energética PDD 2004).

2. Programmatic CDM

Markowitz's portfolio theory (Markowitz 1952) influenced the risk-return model of investment and demonstrated how potential liabilities can be lowered by pooling in various assets, thus rendering portfolio investments a lower-risk proposition. In CDM projects, this can be achieved through two means:

- The diversification of plant specific risk which is a mixed portfolio of different kinds of renewable energy CDM projects like hydropower and biomass (Laurikka 2008).
- The consolidation of smaller same-sector CDM programmes within one umbrella project.

This is where programmatic CDM is an excellent proposition for small scale CDM developers to pool their resources and reduce costs and risks. The Programmatic CDM essentially increased participation in the CDM process by allowing those projects that were too small in scale to be standalone projects to be bundled together with other small CDM projects (IBRD 2010). Traditional CDM focussed on individual standalone projects which tended to have an exclusionary effect on the vast majority of small parties interested in developing niche or small community oriented projects. Small scale projects were shown to lack the financial investments to cover the high transaction costs for CDM projects even after the rules governing CDM was revised to make small scale projects simpler and less expensive (Brunt and Knechtel 2005). A proposal was made to introduce bundled up projects under programmatic CDM in the hopes that they would reduce overall costs for small scale projects even more and have the capacity to take advantage of local knowledge and expertise. Thus programmatic CDM was the next step in small scale CDM projects.

Programmatic CDM was set forth as an evolved, inclusive form of CDM which would be capable of achieving more sustainability effects. This was earlier done by registering a group of projects under the architecture of one Project Design Document but as separate activities. While this form of Programmatic CDM gained popularity in Brazil it did not address the need for a more cost-effective, sustainability promoting CDM (IBRD 2010). One of the new innovations to meet the criteria for sustainability is the Program of Activities which allows more participants in Programmatic CDM by allowing a new programme activity at any time of the project and also allowing multiple baseline methodologies (IBRD 2010). This is significant because even projects in the same sector utilize different baselines depending on the nature of data and the number of variables involved in calculating baselines. The Program of Activities has decreased transaction costs by requiring that the CDM project cycle only be completed once and it also encourages economies of scale by allowing collaborative efforts between the various project activities. An Example of a Programme of Activities in Brazil is the Wind Power Programme of Activities registered in 2011. This project consists of a number of wind farms (being developed by different entities) being managed under one managing entity, the Deutsche Bank (Wind Power Programme of Activities, 2011).

A final advantage of programmatic CDM is that they could offer a means of ensuring sustainable development since they allow a deeper engagement with grassroots communities which facilitates a more integrated approach (Boyd et al. 2009: 829).

Key CDM Sectors for Brazil

This section analyzes CDM projects in Brazil across renewable energy (hydroelectricity and wind energy), forestry (afforestation/reforestation) and fugitive emissions (end-of-pipe) projects. A detailed analysis has been conducted for renewable energy projects, particularly hydroelectricity and wind energy, as well as the forestry sector. The rationale for choosing each sector is as follows:

Renewable energy has been emphasized for its ubiquity, its important role in mitigation and the role it plays in fostering a clean energy mix. Forestry projects have been selected because of the role of deforestation and land use change in contributing to Brazil's emissions profile and their vital importance in the emissions trading market. An analysis of forestry projects can give insight into how to overcome the barriers that have prevented them from being more popular with CDM developers. Finally, N2O projects have been selected for a brief analysis of end-use-projects because their study exemplifies the core criticisms directed at the CDM.

Table 1: Sectoral Break up of CDM Project Activities in Brazil

For the Year 2010

Sector	**Number of Projects (*Registered and Under Validation)***	**Emission Reductions (in tonnes)**	**Percentage of GHG Reductions**
Renewable Energy	228	146,091,126	37.5
Swine	75	38,998,139	10
Landfill	36	84,210,095	21.6
Industrial Process	14	7,449,083	1.9
Energy Efficiency	28	19,853,258	5.1

Waste	17	5,002,110	1.3
N20 Reduction	5	44,617,272	11.5
Fossil Fuel Switch	45	27,630,240	7.1
Reforestation	2	13,033,140	3.3
Fugitive Emissions	3	2,564,802	.7
Total	453	389,449,265	100.0

Source: UNFCCC, Project Registration 2011

Table 2: Sectoral Share of GHG Emissions in Brazil, 1990 – 2005*

Sectoral share of GHG Emissions	1990	2000	2005	% Share in emissions in 1990	% Share in emissions in 2005
Agriculture/Husbandry	347	401	487	25.4%	22.1%
Energy	215	328	362	15.8%	16.4%
Industrial Processes	27	35	37	2%	1.7%
Wastes	28	41	49	2%	2.2%
Land Use Change	746	1247	1268	54.8%	57.5%
Total	1362	2052	2203	100%	100%

**Emissions are measured in Million tonnes of CO2 and CO2 equivalents per annum*

Source: Ministry of Science and Technology (MCT) 2009

1. Renewable Energy Projects

Considering the importance of renewable energy projects in mitigation activities and the investors' dilemma they pose, this section is being presented in greater detail. Wind energy is receiving greater focus because of the under-exploited mitigation and development potential it possesses. The sustainability benefits are being emphasized to underline the value-addition brought about by CDM in a sector that is considered close to saturation in Brazil.

Risks and Determinants of Investment in Renewable Energy Projects

Investments in renewable energy depend on the three factors of policy, risk and return (Wustenhagen and Menichetti 2012). Renewable energy investments are also influenced by the availability of opportunities for certain kinds of projects. The investments chosen are those which give the highest returns for a certain kind of risk. One common risk in renewable projects is the kind derived from environmental externalities.[47] Brazil's energy policy in conjunction with CDM incentives operate to reduce the impact of such externalities.

Ordinarily, the decision to invest in the renewable energy sector (and the ensuing choice regarding what mix of renewable energy—solar, hydro, biomass or wind—the project developer would like to invest in) involves making a strategic choice between a complex and ambiguous range of variables. A strategic choice arises when there is a one-off, difficult-to-reverse choice involving a decision to commit scarce resources like money, energy or expertise (Wustenhagen and Menichetti 2012). In terms of renewable energy these choices involve the cost of energy of conventional energy versus the returns on renewable energy, the growth of sales for renewable energy, research and development costs, firm size and debt-to-equity ratio (Wustenhagen and Menichetti 2012). Interestingly enough, the risk for renewable energy projects in Brazil are lower than the risks for other industries (Donovan and Nunez 2012). This is largely a result of the institutional support structures that Brazil has built over the last few decades as explained in chapter 2.

An interesting determinant of investment in renewable energy is the effect of psychological factors on risk-return perception (Wustenhagen and Menichetti 2012). The bundle of cognitive biases operational at the time of investment decisions can lead to the phenomenon

[47] Externalities can be either positive or negative effects experienced by those not participating in the creation of those effects and arising out of the actions of other individuals or groups. These effects are unintended and do not result in compensation to the affected parties and are not experienced by the party involved in the activity (Owen 2004: 129).

of path dependence (Goldstone 1998).[48] Path dependence is the tendency for past decisions or events to influence choices in the present and in the current scenario of the high carbon trajectory the world in general is on, makes the decision to switch to low carbon renewable energy that much harder (Lovio 2011). This is because of perceptions based on past experiences when renewable energy was a high-risk proposition (Lovio 2011). These perceptions are also the reason why frequent policy changes or political regime changes can negatively influence investors' expectations of risk. Therefore, even though not all the regional environmental policies in the states of Sao Paulo, Amazonas or Minas Gerais have included CDM as a primary focus for mitigations, the attractiveness for investors towards these states is higher. This is mainly due to the fact that green public policies reduce investors' perceived risk and give credibility to green energy policies (Wustenhagen and Menichetti 2012).

Hydroelectricity

Hydroelectricity, followed by wind energy and biomass energy have been the three primary constituents of renewable energy CDM projects in Brazil and they have accounted for 54.9% of all CDM projects (UNEP Risoe 2012). Hydroelectricity's popularity in Brazil can be attributed to three reasons: The advanced state of development of hydroelectricity and the technical sophistication of this form of energy; the comprehensive institutions and legislation supporting hydroelectricity in Brazil; and the high energy density of hydroelectricity which contributes to greater GHG mitigation (International Hydropower Association 2010: 2). This popularity of hydroelectricity has extended to the CDM as well with Brazil registering a total of 116 CDM hydroelectricity plants. [49]

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[48] Daniel Kahneman and Amos Tversky introduced the idea of cognitive biases in prospect theory that can lead to illogical decisions and perceptual distortions. Kahneman has done a lot of work on cognitive biases like anchoring biases, reporting biases, framing and so on. Prospect theory is a behavioural economic theory describing the process and likely outcomes of decisions when the different alternatives have some element of risk attached to them and the outcome is largely unknown. This theory is used to determine investment probability as well (Post et al. 2008).

[49] The states with the greatest number of the projects are Goiás (8 projects), Mato Grosso (19 projects), Minas Gerais (19 projects), Rio Grande do Sul (19 projects), Rondonia (7 projects) and Santa Catarina (16 projects) (UNEP Risoe 2012).

CDM hydroelectricity projects are cheaper and offer more benefits in comparison to non-CDM projects. The Brascan Energética hydro project in Minas Gerais which comprises a group of small hydroelectric plants exemplifies the key advantages offered by CDM hydro projects over regular hydroelectric plants such as: allowing lower reserve margin requirements[50]; improved power quality because of their responsiveness to energy requirements of specific areas; reactive power control depending on demand and supply conditions; reduced line losses; and the production of energy with lower investments in transportation and distribution (Brascan Energética PDD 2004: 3).

Sustainability Impacts for Hydroelectricity

Hydroelectricity CDM projects have sustainability benefits which fall under the following categories: the production of clean renewable energy, conservation of national resources and energy efficiency, diversification of electricity generation, creation of employment opportunities, local community development, financing for local governments, technology transfers, livelihood generation, river sustenance and the greening of catchment areas (Ceran's 14 de Julho Hydro Power Plant CDM Project Activity PDD 2009; Sao Joao hydro power plant PDD 2007).

Wind Energy

In spite of the venerated status conferred on hydroelectricity in Brazil, its geographical characteristics can play a limiting role in hydroelectricity generation in the country. The spatial reach of these projects is curbed due to inaccessibility issues and during the dry season hydroelectric power plants cannot be operated to full capacity. Considering, the projected influence of climate change in contracting rainfall and the recent droughts in Brazil, wind power could play an important supplementary source of energy in Brazil. Since Brazil’s northeast is prone to droughts and offers the ideal requirement of windy shores, wind power is being promoted as an important alternative for Brazil to diversify its renewable energy portfolio (GWEC 2011). Brazil’s wind power potential is higher than 350 GW and has the advantage of being a source of energy around the year, rather than being

[50] This applies in the case of energy producing CDM plants. The reserve margin for a project is the minimum amount of excess energy capacity for a plant over the energy load at peak hours.

limited to a few seasons (GWEC 2012). Approximately 95% of all wind power projects that have been passed in Brazil have been through the Incentive Program for Alternative Electric Generation Sources (PROINFA) initiative of 2002 with the remaining projects being through CDM (UNFCCC 2012; GWEC 2012).[51] The remaining projects have been launched through CDM.

Wind energy has also helped boost CDM participation in the north-eastern regions of Brazil- an underrepresented region otherwise (UNEP Risoe 2011). The north and north-eastern regions of Brazil comprising of the states of Acre, Amapá, Rondônia, Amazonas, Pará, Roraima, Tocantins, Paraíba, Maranhão, Piauí, Ceará, Sergipe Pernambuco, Alagoas, Bahiahas and Rio Grande do Norte have marginal representation in the aggregate share of CDM projects. While they represent 63.53% of Brazil's territory, they account for a mere 13.15% of all the CDM projects registered in Brazil (UNEP Risoe 2012; UNFCCC 2012).[52] Wind energy accounts for 46 projects for the north and north-east which is 70.76% of the total CDM projects for that region (UNEP Risoe 2012).

CDM has helped minimize some of the limitations faced by the wind power industry such as: the mobilization and financing of projects; gaining access to technological innovations in wind power and incentivizing the development of technological innovations which are ideal for Brazil; building infrastructure and arranging logistics related to supply and demand for the transfer of wind energy to its end users (GWEC 2011: 8).

Sustainability Impacts for Wind Energy

One of the most significant effects of wind energy projects has been their adoption in Brazilian regions that have economic and infrastructural inadequacies (Rio do Fogo Wind

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[51] There are CDM projects being developed under the PROINFA initiative as well such as the Rio do Fogo wind energy project in the state of Rio Grande do Norte (Rio do Fogo Wind Energy Project PDD 2006). The CDM-PROINFA collaborative framework is often used because technical and financial barriers cannot be adequately addressed through the state's institutional infrastructure. PROINFA incentivized renewable energy sources and allowed the Brazilian government to buy electricity generated through wind, biomass, wind small hydropower plants.

[52] As of May 2012 the North and North-Eastern region account for 65 of the 494 projects in all of Brazil (UNEP Risoe 2012). It is the host region for 46 of the 77 wind energy projects in all of Brazil.

Energy Project PDD 2006). These regions have immense wind power potential but do not attract renewable energy investments under government incentive schemes because of their distance from developed centres, lack of supportive infrastructure, financial and technical constraints (Rio do Fogo Wind Energy Project PDD 2006;). The large number of CDM wind projects in the regions of Ceará and Rio Grande do Norte, which do not otherwise see any CDM investment, has helped these states earn revenue; build regionally and nationally connected energy grids; and become net exporters of energy[53]. These regions also have the potential to earn income from the tourism industry through the lure of big wind farms like the massive-scaled Osorio project (Osorio Wind Power Plant Project PDD 2004).

The operation of these projects reduces local air contaminants such as CO2, NO2 and CH4 (Serra dos Antunes wind farm 2008). There are no solid or liquid effluents produced as a by-product of wind energy projects. These project sites often see substantial job creation due to construction and maintenance and operational requirements (Rio do Fogo Wind Energy Project PDD 2006). Vocational training is often provided. The initial stages of operation do not require very skilled workers either. Community development initiatives such as educational, social, environmental and technical programmes are taken up quite often such in project areas and project developers often make donations for social infrastructure such as schools and hospitals.[54] Infrastructural projects like building roads to increase accessibility are often taken up unilaterally by the project developers (Rio do Fogo Wind Energy Project PDD 2006; Osorio Wind Power Plant Project PDD 2004).

In the case of wind energy projects, local stakeholders often raise concerns over potential negative environmental impacts such as the effect on the migratory patterns of birds, noise pollution and visual impacts (Rio do Fogo Wind Energy Project PDD 2006; Serra dos Antunes wind farm PDD 2008). In the projects studied, these concerns have been addressed

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[53] In these two regions of Ceará and Rio Grande do Norte, 43 of the 45 CDM projects are wind energy related projects (UNFCCC 2012).

[54] The project developers for the Rio do Fogo Wind Energy Project contributed to welfare oriented programmes in the local community. However, it is generally seen that donations or contributions made by project developers are notusually reported in any formal validation report and cannot therefore, not be be verified independently.

by building wind turbines upwind and away from local settlements and habitats of migratory birds, sensitisation literature for local populations and those responsible for operating the projects, hydrological studies and also conducting periodic monitoring programmes (Rio do Fogo Wind Energy Project PDD 2006; Serra dos Antunes wind farm PDD 2008).

Barriers to Renewable Energy under Business-As-Usual Conditions

1. **Financial Barriers**: In wind energy projects, the risk associated with the development of expensive and long term wind farms in regions (like the north and north-east) are deterrents to finding project partners without offering a guarantee of a minimum level of returns (Horizonte Wind Power Generation Project 2006; Osorio Wind Power Plant Project PDD 2004). These guarantees can be furnished either in the form of pre-existing agreements for the purchase of CERs or from contracts for the sale of energy to the Brazilian national grid (Osorio Wind Power Plant Project PDD 2004).
2. **Technological Barriers:** For maximum GHG mitigation potential, cutting edge technology needs to be developed. For CDM projects in renewable energy projects like hydroelectricity which is already ubiquitous in Brazil, demonstrating additionality is only possible through the use of efficient and cost effective technology. Technology transfers and collaborations do help solve some of these issues but certain technological issues which are only endemic to Brazil cannot be solved without indigenously created solutions (Horizonte Wind Power Generation Project 2006). Training a workforce to be able to handle new technology can be expensive and time consuming.
3. **Environmental Barriers:** The production of renewable energy is contingent on the reliability of natural resources and environmental factors. Hydro energy needs a steady supply of water and periods of drought can dramatically reduce output levels. Wind energy carries the highest risks because of the fragmented and unreliable supply of strong winds to power wind mills (Horizonte Wind Power Generation Project 2006: 11).

4. **Other Barriers:** In small communities, renewable energy projects are sacrificed in favour of fossil fuel run energy plants because of scale and cost considerations. The recent discovery of large natural gas reserves in the Santos basin in Brazil also shifted the government's focus to thermal plants (Sao Joao hydro power plant PDD 2007). This stage of temporary energy related myopia is being supplanted by a resurgence in small scale CDM hydroelectricity plants.

2. Forestry Projects

Forests play an important role in global carbon cycles as carbon stores and are also a significant contributor to atmospheric carbon in their role as carbon sinks [55] (Brown et al. 2002). Changes in forested patterns such as deforestation and land use change contribute a substantial 57.5% of Brazil's emissions profiles. This is why Brazil's unilateral plan to decrease GHG emissions from between 36.1% to 38.9% by 2020 proposed that the largest contribution to decreased emissions would be from forestry and land use changes (Enerdata 2011).

There are three kinds of forestry related CDM projects with the commonly employed CO2 mitigation strategy being emissions reductions or non-sink activities. The second category of projects is carbon sequestration which involves increasing the ability of plants to absorb or sink atmospheric CO2 through the process of photosynthesis (Zomer et al., 2008). Carbon sequestration is the name given to the semi-permanent carbon fixation done through forests or recalcitrant organic matter in soils (Zomer et al. 2008). CDM's afforestation/reforestation (AR) category of projects allows sink projects that assist with the carbon sequestration process by growing more trees through organized practices of AR. Even though the CDM has performed below expectations in AR projects the development community believes that given the right incentives CDM-AR driven investments can encourage rural development and environmental protection (Zomer et al. 2008). The third category of CDM projects is the substitution of sustainably grown wood for energy intensive and cement based production

[55] Forests act as carbon sinks under two cases—their destruction due to human-origin or natural causes and when there are changes in the pattern of land use resulting in reduced forest cover.

like construction material (Brown et al. 2002). The projects described above come under the category of Land Use, Land Use Change and Forestry (LULUCF). Brown et al. (2002) explain how these CDM LULUCF activities meet sustainable benefits like sustainable forest development; creating a renewable source of industrial wood and fuel production; the protection of soil, water and biodiversity; recreation; rehabilitation of damaged lands and so on. [56]

Research shows that afforestation plantations on 465 million hectares of land are enough to compensate for projected increases in carbon emissions between the next 30 to 50 years (Sedjo and Solomon 1989). Despite the fact that afforestation fits within the scope of CDM activities there has been a surprising paucity of afforestation and reforestation (AR) projects in Brazil. Globally, there have been 39 CDM projects approved since 2006 with 29 of the registered projects located in Latin America and just 4 of those in Brazil (UNEP Risoe 2012). This is surprising because of the nine Amazonian countries,[57] Brazil includes 60% of the rainforest followed by Peru with 13% coverage and Colombia with 10% coverage.[58]

Smith et al. (2000) believe this asymmetry between potential and ground reality is inevitable because in a market based system, investments in forestry related CDM projects will depend on the costs of pursuing such projects relative to other available alternatives. This is similar to Wustenhagen and Menichetti's (2012) risk analysis which was covered in the previous section. AR projects do not seem as attractive to investors when compared with the relatively easier returns on other project types. The added difficulty with making a cost-

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[56] Avoided Deforestation activities are not allowed to earn CERs (though they are eligible to earn other categories of non-Kyoto Protocol carbon credits) because of the Kyoto Protocol's insistence that firstly, credits can only be earned from changes in the use and management of the land that occurs due to human inducement and secondly, the activity generating the carbon credits must be measurable, transparent, and verifiable (Brown et al. 2002).

[57] Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname and French Guiana.

[58] All four of the Brazilian forestry CDM projects are reforestation projects: Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil in Minas Gerais II (currently registered), AES Tiete Afforestation/Reforestation Project in Sao Paulo and Minas Gerais (currently registered), Vale Florestar Reforestation of degraded tropical land in Brazilian Amazon in Para (pending publication/requested registration) and Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil in Minas Gerais I (validation stopped).

benefit survey of forest related resources is because of the contention over the ideal methodology to make estimates. However, considering the important role played by forest resources in the emissions and mitigation equation for Brazil, forestry projects are being given greater attention in Brazil's CDM project mix. Also, even though pure A/R projects are in a minority, there are numerous other CDM projects which include forest management as important elements of their project purpose. Charcoal production, forest biomass, bagasse power and agricultural residue plants are some of these allied CDM projects.[59]

The two projects selected for analysis are illustrative of the contrasting purposes and characteristics of afforestation projects. The AES Tietê Afforestation/Reforestation Project- The project activity plans to reforest up to 13,939 hectares of riparian areas occupied by unmanaged grassland along the banks of ten hydropower reservoirs in the State of São Paulo with native forest species (AES Tietê Afforestation/Reforestation PDD 2011). [60]As is common with CDM projects the objectives are usually multipronged and the AES Tietê project aims at restoring the ecosystem of the riparian forests along the hydropower reservoirs it will develop and increasing carbon sequestration (AES Tietê Afforestation/Reforestation PDD 2011).

The Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil CDM project located in the state of Minas Gerais is aimed at establishing plantations as a renewable source of energy for industrial needs. [61]This project is expected to achieve the generation of carbon stocks and GHG removals by the sink effect that the new plantations would have (Reforestation as Renewable Source of Wood Supplies PDD 2010). The project is also expected to reduce GHG emissions in Brazil's iron and steel industry through the use

[59] The Plantar Project registered in 2007 in the state of Minas Gerais is a charcoal production plant aimed at reducing carbon emissions and serving additional environmental benefits by the reforestation of the project area with eucalyptus trees.

[60] As is true with many CDM projects, the developer was granted a long term land grant of 30 years to develop the hydrological potential of the area.

[61] Charcoal plays an important role in industries as a fuel and feedstock for pig iron manufacturing (La Rovere et al. 2008).

of sustainable sources of biomass in place of fossil fuels and non-renewable biomass (Reforestation as Renewable Source of Wood Supplies PDD 2010). A closer study of the specific modalities of this project may put in doubt its effects on emissions reductions (it does not provide a cleaner source of fuel, just a sustainable source) but they reflect Brazil's legislative requirements. In 1989, a decree under the Brazilian Forestry Code called upon large-scale wood consuming industries to create the plantation sources required to supply their production activities.

Sustainability Impacts for Forestry Projects

The projects studied promise to deliver global and regional sustainable development. They aim to provide local environmental sustainability through the increase of local biodiversity, conservation of water resources, increasing carbon sequestration, stopping and reversing land degradation and also providing employment opportunities and environmental connectivity (AES Tietê Afforestation/Reforestation PDD 2011). The income redistribution effects seem to be quite weak based on the PDDs. AES Tiete proposes to achieve this through the purchase of seedlings from third parties (AES Tietê Afforestation/Reforestation PDD 2011). Technological Development and Capacity Building is achieved through partnering with organizations for conducting scientific and practical activities.

Issues Regarding Additionalities in Forestry Projects

A concern regarding CDM forestry sink projects is that they would have occurred irrespective of the operation of the Kyoto Protocol because of commercial or political reasons and would therefore not be a reliable indicator of GHG mitigations taking place due to CDM (Brown et al., 2002). Examples of projects such as these would be the kind that offer generous financial benefits in the business-as-usual scenario, like an industrial plantation for pulpwood (this would be a reforestation project under CDM) but it would fail the additionality test because it would have been adopted regardless of its mitigation impacts (Chomitz 2000).

Sustainable Development of Communities through Forestry CDM Projects: Using CDM to Address the Concerns of Indigenous Communities

There have been concerns that the process of converting forest resources into financial assets through the carbon market is a potent tool for exploiting forest resources and indigenous communities in the project area (Saunders et al. 2002). This may not necessarily be true. Available literature suggests that merely including previously marginalized communities in mitigation activities like the CDM fosters a culture of sustainable development—thus decreasing abatement costs (Skutsch 2004 ; Cavallaro 2005; Subbarao and Lloyd 2010). In rural and forested areas this has been shown to be positively correlated with environmental, social and economic benefits (Cavallaro 2005). Community based renewable energy CDM and emissions trading projects also have cascading benefits on poverty and rural livelihoods. This section showcases an example illustrating how the carbon market is not always a demonizing force and can be made responsible towards and cognizant of the rights of indigenous and marginalized communities.

The history of development has often spawned narratives and practices that have marginalized and exploited indigenous populations. Forestry carbon projects illustrate the relationship between poverty alleviation, environmental growth and economic development which is why sustainability is the key in promoting forestry CDM projects (Saunders et al. 2002). The United Nation's Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation's (UN-REDD) carbon market project in the state of Acre, which is poised to earn millions of carbon credits per year, is one such example of how Brazil has democratically engaged with the indigenous people of the Amazonian state of Acre in a way that encouraged participation in the carbon market, provided sustainable benefits and included indigenous communities in the decision-making process. Acre is a state with a predominant population of rubber tappers or *seringueiros* (Shankland 2011). In solidarity with the identity of the indigenous and settled populations as forest dwellers dependent on forest resources for their livelihood, the state government implemented the *florestania* movement to re-affirm Acre's identity as a forest society[62]. This notion of *florestania was* taken so seriously by the state governments, that henceforth, registering REDD and CDM projects required that due emphasis be given to the rights and interests of the forest people. In 2010, Acre passed Law no 2.308/2010 establishing the System of Incentives for Environmental Services (SISA) to preserve and foster a forest-based, low-carbon economy (World Bank 2012). The millions in carbon credits has also brought in valuable financial assets to this impoverished state.

Barriers to Forestry Projects under Business-As-Usual Conditions

1) **The absence of a Precedent:** The AES Tietê project was the first of its kind in Brazil with no other initiative that aimed at recovering original forest vegetation in the catchment area of hydroelectric plants (AES Tietê Afforestation/Reforestation PDD 2011). There were logistic and technical problems that had to be overcome.
2) **Institutional Barriers:** The absence of enforcement of legislation related to forest or land use have the potential to hamper attempts at reforestation. There is no guarantee of protection of young seedlings even within the project areas in the initial stages (AES Tietê Afforestation/Reforestation PDD 2011; Reforestation as Renewable Source of Wood Supplies PDD 2010).
3) **Technological Barriers:** Large scale reforestation efforts are hampered by the paucity of high quality seedlings representative of the species diversity that is required (AES Tietê Afforestation/Reforestation PDD 2011; Reforestation as Renewable Source of Wood Supplies PDD 2010).
4) **Methodological Concerns**: The calculation of baselines and additionalities becomes problematic with forest resources because estimates vary depending on the methodology employed as well as the comprehensiveness of carbon sources that are included. A detailed analysis would be expensive and would need to factor in data regarding levels of soil carbon, end use carbon, above and below ground carbon and so on (Smith et al., 2000).

[62] The word florestania is a portmanteau of *floresta* (forest) and *cidadania* (citizenship) (Shankland 2011).

5) **Problems Regarding Leakages:** A leakage occurs when there is an unanticipated change in GHG benefits beyond the accounting boundary of a CDM project as a result of the project activities potentially due to impacts exerted by the market dynamics between supply and demand; and when the source of GHG emissions is not removed or mitigated but merely shifted to outside the boundary of the CDM project (Brown et al., 2002). These kinds of leakages are associated mostly with forestry and energy CDM projects.

6) **Biodiversity Concerns**: There are concerns that the practice of monoculture is encouraged in large plantation projects. The Reforestation as Renewable Source of Wood Supplies CDM project chose plant species exclusively from the eucalyptus family, a fast growing species of tree aimed at achieving a high productivity of sustainable biomass which could potentially affect biodiversity (Reforestation as Renewable Source of Wood Supplies PDD 2010).

3. End-of-Pipe Projects

The CDM is ideally meant to work as a mechanism that helps projects plough back earnings from CERs into financing mitigative and developmentally oriented activities rather than just increasing returns on existing projects (Pearson and Loong 2003). However, this was not always the case. In the early days of the CDM there were a disproportionate number of industrial gas projects globally, such as HFC-23 and N2O decomposition projects, which are capable of yielding a large number of CERs but do not provide comparable sustainable benefits. Even though there were only 5 N2O CDM projects in Brazil which represented a mere 1.1% of total CDM projects (registered and awaiting validation), they accounted for 11.5% of the total CERs issued (UNEP Risoe 2011). The reason for the high density of credits yielded is because N2O is a GHG with a very high Global Warming Potential of 310. For instance, the N2O Emission Reduction in Paulinia accounted for a massive 59,61,165 (metric tonnes of CO2 equivalent) as opposed to a reduction of 6,70,133 units for the Brazil NovaGerar Landfill Gas to Energy Project over a similar period of time. Therefore, the sheer ‘density’ of the gas adds up to a significantly higher level of GHG mitigations in a more contracted period of time and for lower costs. Rhodia's two N2O emission reductions CDM plants in Brazil exemplify how end-of-pipe projects can exploit loopholes in CDM to make profits from their own polluting activities. Rhodia is a France based company which has registered N2O emission reduction CDM projects in Brazil to essentially offset the emissions created from its own industrial units in Brazil. Since Brazil does not have international or nationally mandated emissions limitations requirements, not only was Rhodia *not* penalized for running an inefficient and polluting enterprise, but it also made profits off that pollution (Climate Change Corp 2012).

An analysis of the two Rhodia N2O CDM projects 'N2O Emission Reduction in Paulínia' and 'N2O Emission Reduction in Nitric Acid Plant in Paulínia' shows negligible sustainability benefits even though they accounted for 60,41,274 tonnes in GHG emission reductions (N2O Emission Reduction in nitric acid plant Paulínia PDD 2007; N2O Emission Reduction in Paulínia PDD 2005)[63]. The additional benefits listed by these projects in their PDDs cover the three parameters of health, personal safety and environment (N2O Emission Reduction in nitric acid plant Paulínia PDD 2007). The technological contribution made by these projects includes the development of new, cost-effective, energy-saving catalysing processes for breaking down N2O (N2O Emission Reduction in nitric acid plant Paulínia PDD 2007).

These oft-maligned N2O projects are a clear outcome of the CDM alone because of the lack of Brazilian controls or obligations to reduce N2O emissions considering their negligible effects on the local environment as well as the high costs of abatement technologies which would render a non-market supported reduction strategy unfeasible (N2O Emission Reduction in nitric acid plant Paulínia PDD 2007).

Barriers to Industrial Effluent Reduction and N2O Reduction Projects

1. **Lack of Non-CDM Precedent**: Without the funding opportunity afforded by CDM these N2O projects wouldn't have existed in all probability (Project N2O Emission

[63] The total number of CERs received by the 'N2O Emission Reduction in Paulínia' project is a massive 36.4 million CERs since 2007, making it one of the Clean Development Mechanism's top recipients of carbon credits (Point Carbon 2012).

Reduction in nitric acid plant Paulínia PDD 2005). This is because of the lack of debt funding for previously unproven projects using innovative technology (Project N2O Emission Reduction in nitric acid plant Paulínia PDD 2005). International capital markets are unresponsive due to risks (real and perceived) associated with untested projects.

2. **Lack of Trained Human Capital**: Exploiting new technology and manufacturing processes requires training workers for highly specialized and niche skills (Project N2O Emission Reduction in nitric acid plant Paulínia PDD 2005; N2O Emission Reduction in nitric acid plant Paulínia PDD 2007). There are considerable costs involved in the initial training and language barriers prove detrimental to the task.

Sustainability and CDM

The requirement of sustainability in the CDM is structured along two poles: the host county's perception of what constitutes sustainability in the context of its development agenda; and the market's demand for projects which deliver on sustainability impacts or 'high quality CDM projects' which yield higher price CERs (Bumpus and Cole 2010). On a macro scale, a sustainably implemented CDM includes providing funding to help developing countries meet their developmental objectives ranging from poverty alleviation among the rural poor; increasing the capacity for developing countries to adapt thus reducing the vulnerability to climate change; technology transfer for cheaper large scale mitigation solutions; protection of water and soil resources; and knowledge building and awareness about climate change.

The findings of Boyd et al. (2009) suggest that in cases where the country's DNA holds the project developers to higher standards of accountability, the sustainability benefits and environmental integrity of the project will be greater. This is true of Brazil where the principal arbiter for the sustainability assessment of these CDM projects in Brazil is its DNA, the CIMGC, which issues pre-project and pre-validation reports verifying whether a project has achieved sustainability goals.[64] Along with the CIMGC, the Brazilian context of sustainability is also contained in Agenda 21 and the Sustainability Development Criteria of Brazil[65]. However, the local communities and stakeholders also have the authority to comment on their concerns about the sustainability of CDM projects. In such cases the project developers, are required to have a public audience to address issues regarding the recognition and formalization of ownership rights of the people; risk management of populations and the natural resources and compensation in case of the displacement of people and fauna (Sao Joao hydro power plant PDD 2007: 33). This method of engagement with communities maximizes sustainable benefits and prevents unsustainable practices. The fact that not just the CDM but also the Brazilian environmental licensing regime requires this engagement makes for more robust sustainable benefits[66].

According to Cole and Liverman (2011: 12) better sustainability for CDM projects can be achieved through three means:

- Developing a strong civil society in Brazil along with adept local government actors.
- Enhancing the institutional capacity of Brazilian regulators in their ability to create and enforce legislation and regulations.
- A deepening and expanding network of ministries and other actors that can coordinate in their efforts to build a broad set of criteria defining sustainable development in the context of climate change mitigation.

To analyze the extent to which the CDM has actually resulted in sustainable gains for Brazil, this section gives an analysis of the sector-wise sustainability gains from CDM projects.

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[64] In the pre-operational stage, it is the CDM project's PDD that outlines anticipated and planned sustainability linkages. Once operation begins, the validation report contains a brief comment from the DNA regarding the sustainable development goals of the project.

[65] Agenda 21 is a framework for action and recommendations for achieving sustainable development by governments, UN organizations and other major groups. The decision to adopt agenda 21 was taken at the United Nations Conference on Environment and Development (Earth Summit) at Rio in 1992. Many countries, including Brazil, have their own versions of the Agenda 21 which are specifically suited to its national priorities. However, Agenda 21 is not part of Brazil's official national sustainable development strategy(Swanson et al., 2004).

[66] The Article 10 of Resolution 237/97 of the Brazilian Environmental License requires that a public audience be called to resolve issues as and when they arise.

Criteria for Selection

Projects in sectors with approximately 10% share in the total CDM pipeline share for Brazil have been chosen. Only registered projects (registered from 2004 to 2010) have been selected, including those with revised PDD and monitoring plans. Generally, projects with the highest share of issued CERs in each sector have been included but in certain cases, projects with lower returns have been chosen to provide a more geographically diverse selection for analysis. Project Design Documents (PDD) and validation reports are the primary sources of information for this analysis[67]. Since these are standardized templates providing documentation about each project in the pre-registration stage, they lend themselves to a more systematic and coherent analysis. PDDs don't have a section that requires project developers to explicitly state whether or not concrete technology transfers have taken place, but most PDDs analyzed did mention whether or not the transfers took place and the nature of the transfers. Another caveat of CDM analyses through PDDs is that the analyses is based on self reporting and primary project documentation may not always show an accurate picture of 'local struggles and other development and climate mitigation alternatives may remain invisible...because project developers may be biased in selecting participants for stakeholder consultations, thus under-representing critical views in project reports' (Boyd et al. 2009: 826).

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[67] Sirohi (2007) had undertaken similar analyses of the sustainable benefits of CDM by studying the PDDs of 65 projects and found that their contribution to local development was negligible at best.

Table 3: CDM Projects Analysed for Sustainability Benefits and Technology Transfers

Name of the Project	State	Project Type	Sustainable Benefits	Technology Transfer (TT)
Rio do Fogo Wind Energy Project	Rio Grande do Norte	Wind Energy	Clean Energy, Employment Opportunities, Infrastructure, Educational Awareness Contribution for Local Community Development	Yes
Osório Wind Power Plant Project	Rio Grande do Sul	Wind Energy	Clean Energy, Employment Opportunities, Infrastructure, Tourism, Vocational Training, Environmental Awareness Programmes	Yes
Horizonte Wind Power Generation Project	Santa Catarina	Wind Power	Clean Energy Employment Opportunities, Environmental Protection,	Unclear From Project Document
Sao Joao hydro power plant	Espírito Santo	Hydroelectricity	Clean Energy, Employment Opportunities, Local Community Development, Greening of Catchment Area,	Yes
Ceran's 14 de Julho Hydro Power Plant CDM Project Activity	Rio Grande do Sul	Hydroelectricity	Clean Energy, Employment Opportunities, Local Community Development, Greening of Catchment Area, Environmental Education	Yes
NovaGerar Landfill Gas to Energy Project*	Rio de Janeiro	Landfill Gas	Emissions Reductions, Employment, Sanitation and Health Improvement, Minimization of Risk to Local environment, Improved Quality of	Yes

			Living, Clean water and Improved Soil Quality, Aesthetic Enhancement, Greening of Catchment	
Electric Power Co-Generation by LDG Recovery	Espirito Santo	Electricity Efficiency	Emissions Reductions, Economic power generation, Employment	No
Onyx Landfill Gas Recovery Project – Trémembé, Brazil	Sao Paulo	Landfill Gas	Emissions Reductions, Waste Management, Employment Revegetation and Reforestation, Sanitation and Health Improvement, Infrastructural Improvements, Knowledge Dissemination, Training	Yes
Landfill Gas to Energy Project at Lara Landfill, Mauá, Brazil	Sao Paulo	Landfill Gas	Emissions Reductions, Waste Management, Employment, Sanitation and Health Improvement, Dissemination of Best Practices, Improvement in Labour Conditions	Yes
Inacio Martin's Biomass Project	Parana	Methane Avoidance	Clean Energy, Emissions Reductions, Diversifying Energy Sources, Employment, Waste Management Through Utilization of Wood Residues	Yes
GHG capture and combustion from swine manure management systems	Parana	Methane Avoidance	Clean Energy, Emissions Reductions, Employment, Diversification of Energy Sources	Yes
Granja Becker GHG Mitigation Project	Minas Gerais	Methane Avoidance	Clean Energy, Emissions Reductions, Employment, Diversification of Energy	Yes

* As the very first CDM project to be registered, NovaGerar also served as demonstration project illustrating how CDM could be used as a financial mechanism to fund clean energy projects.

Results of Sustainability Analysis

An analysis of 12 projects over five different sectors indicates that the greatest gains in sustainable development seem to arise from hydroelectricity projects, wind energy projects and landfill gas projects. In terms of CER earnings (and therefore, the *potential* to employ earnings for investment in further sustainable activities), renewable energy projects are the leaders. Forestry Projects have been left out of the final results because of their limited share in Brazil's CDM project portfolio. Broadly categorized, the sustainable development benefits of the CDM projects studied have ranged from the creation of markets for the sale of crop residues for cogeneration projects, enhanced quality of living through health benefits accruing from less polluting energy sources from CDM projects for fuel-switching and renewable energy, the creation of employment opportunities in project areas and the improvements in employment practices because of the adherence to minimum wages, the imparting of basic and advanced skill training and managerial capacity building. [68]

Infrastructural gains are made through investments in complementary infrastructure for the CDM projects. For instance, in energy projects, this infrastructure could be in the form of new localized energy grids, roads leading directly to project sites. The construction of extraneous infrastructure, which doesn't necessarily have supplementary benefits for the CDM projects alone, has been absent in all the studied CDM projects. Infrastructural development also gives a fillip to local job creation in the blue-collar sector.

One of the most important sustainable development benefits is capacity building. Where there are very limited benefits to local communities, a proportion of returns on the CDM projects can be invested in local development projects. This has been done with the NovaGerar project which donated 10% of the electricity generated on-site to the project area's local municipal authority for the lighting of public buildings, hospitals and schools (NovaGerar Landfill Gas to Energy PDD 2003). Interestingly, this donation was stipulated in the licensing conditions for NovaGerar and shows how conditional transfers of project land for CDM sites by the Brazilian government could help enhance sustainability benefits.

[68] The Osorio CDM project generated approximately 740 new direct jobs as a result of its operation with 160 being created in the project area alone (Osório Wind Power Plant Project PDD 2004).

Technology Transfers

Technology transfers are defined 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, NGOs and research/education institutions' (IPCC 2000:9). Technology transfers have assumed great significance for mitigation efforts because of the ambitious GHG reductions targets that are required of developing countries if meaningful action for minimizing the impact of climate change is to take place. This target requires developing countries to make reductions of 15–30% below the GHG levels of 1990 by 2020—a target that entails a major overhaul of current research and development programmes, massive investments and 'enhanced deployment and diffusion' programmes for developing countries (European Commission 2009; Sepibus 2009: 3). The IPCC (2000) recommends that technological innovation occur continuously and rapidly enough to viably reduce climate change vulnerability and affect mitigation efforts. To unilaterally achieve the scale of technological innovation that is needed or to pay the market price for the acquisition of patents for advanced technology would be prohibitively expensive for developing nations. This is why the technological transfers vaunted by CDM are an ideal buttress for achieving mitigation goals.

Dechezleprêtre et al. (2009) classified technology transfers into two categories: knowledge transfers and equipment transfers. Knowledge transfers take place when the project developers receive 'the transfer of knowledge, know-how and information or technical assistance from a foreign partner' whereas equipment transfers take place when equipment for operating the project arrives from a foreign country (Dechezleprêtre et al. 2009:4). The ideal brand of technology transfer is when knowledge transfers take place concurrently with equipment transfers (Dechezleprêtre et al. 2009). Simple equipment transfers can defeat the purpose of technology transfers if the information related to their up-keep, maintenance and operation are not passed on to the developing country. Also, the capacity for the host country to understand and adapt the technology to cope with ground realities and synergistically apply it with indigenous technologies is an important condition for technology transfers to be effective (Sepibus 2009).

CDM has been lauded for the opportunity it gives to stimulate the transfer and mainstreaming of technological inputs. An analysis of 12 CDM projects in this chapter shows that precedent setting bilateral project types, like the NovaGerar project, have the greatest internationally sourced technology transfers associated with them[69]. A corollary to this result is the observation that technology transfers are more likely to take place for large CDM projects that have European project partners (Seres et al. 2007; Coninck et al. 2007). Countries with a strong GDP growth, open economy or favourable investment climate have a tendency to attract more technology transfers—a hypothesis that finds resonance with Brazil's experience (Sepibus 2009). However, international technology is not always the superior alternative especially where low cost solutions for small scale projects require innovation rooted in the community. Domestic technology can be more prudent in cases where local conditions are dramatically different from those prevailing internationally (Dechezleprêtre et al. 2009).

Based on the projects analyzed, even though renewable energy like hydroelectricity is a ubiquitous source of power in Brazil and is therefore mostly optimized for the country, there are a few cases where issues regarding accessibility or scale necessitate technology transfers. Ceran's 14 de Julho Hydro Power Plant is an example of such hydroelectricity projects. Wind energy projects are associated with equipment transfers like wind turbines with older CDM projects involving both knowledge and equipment transfers. An example of this is the Rio do Fogo Wind Energy Project which used newly innovated German wind turbine technology with the transfer of manufacturing technology being made to Brazil to bring down production costs (Rio do Fogo Wind Energy Project PDD 2006). Most wind energy projects in Brazil are collaborative projects with European nations like Spain (one of the world leaders in wind energy) as project partners—a fact that allows cutting-edge technology transfers to take place more smoothly. The wind sector in Brazil was in its nascency at the inception of the Osorio wind energy project. Transfers took place from a

[69] These 12 projects are the ones included in table 3.3.

German firm for expertise in 'wind energy measurement and prediction, and electric energy output estimate; wind turbine assessment according to site conditions; wind farm construction and operation' (Osório Wind Power Plant Project PDD 2004: 6, Horizonte Wind Power Plant Project PDD 2004).

Landfill gas projects like methane recovery projects have benefitted from knowledge and equipment transfers. The Onyx Landfill Gas Recovery project is an example of this dual transfer. It used technological inputs and material from its European partners, implementing European waste management standards (Onyx Landfill Gas Recovery PDD 2010). The design and operational experience gained from the project was shared throughout the country through the development of brochures and open houses were organized to give training experience to interested parties (Onyx Landfill Gas Recovery PDD 2010). Biomass projects too have benefitted from the transfer of technology. The Inacio Martins Biomass Project in Brazil collaborated with its technical partners to introduce sophisticated new German technology for methane emissions avoidance (Inacio Martins Biomass PDD 2006). This new technology required specialized labour for which German technicians gave training to the local employees of the project.

There are, however, scholars who urge caution in hailing the extent and depth of technological transfers fostered by CDM (Kulkarni 2003). CDM's encouragement to technology transfers is seen more as a normative concept that has fallen short of being realized on a critical scale. Solutions suggested for increasing these transfers range from the mobilization of private sectors to increased collaboration with international, particularly European Union, partners in CDM projects (Coninck et al. 2007).

Conclusion

The CDM has represented a simplification of pivotal cost-benefit analyses that need to be undertaken by investors in sectors that would traditionally be considered risky. However, the CDM has also been used as a tool to shift away the emphasis from a pure profit oriented decision making process. Sustainability is a guiding principle that drives enlightened corporate investment decisions and CDM is the most well recognized tool to achieve this. With this tool the emphasis from a cynical profit-driven bottom line has broadened to include the 'triple bottom line' principle emphasizing the relationship between ecological (mitigation), social (sustainability) and economic (profits/financial viability) factors in measuring institutional success (Perera et al. 2010). This understanding has driven the shift in opinions regarding economic growth and development from an attitude of growth at any cost to responsible growth. Investment in environmentally friendly 'green' services and products is seen as being increasingly important for firms to increase their market share (Perera et al. 2010: 14). Not only does the CDM provide a mechanism for GHG mitigation, it also gives firms (and countries) a medium for pursuing internationally sanctioned, environmentally optimal growth whose risks are offset by the market mechanisms provided by CDM.

However, it is worth noting that the CDM is not a cure-all tool to be used indiscriminately. This has been elaborated on in the case of industrial effluent projects but even a universally acclaimed clean energy sector like hydroelectricity has its critics. There is dissenting scholarship asserting that CDM has distorted the demand for hydroelectricity plants and obfuscated the environmental and social impacts of hydro projects by incentivizing the indiscriminate proliferation of these project types (Haya 2007). An important observation made by Haya (2007) is that while hydroelectricity *CDM projects* have proliferated, this doesn't actually indicate an overall increase in the growth of hydroelectricity plants as a result of CDM because in many cases plants which have already been sanctioned or are in the process of construction apply for CDM registration. Not only does this fail to meet the criteria of additionality which requires developers to show that the project wouldn't have taken place in a business-as-usual scenario (if it were to be stringently applied), it also contributes to padding the carbon market with 'fake' credits—a development which is reminiscent of the sub-prime crisis that led to the global financial meltdown in 2008.

Therefore, a system of responsibly implemented CDM projects with multi-point validations is imperative to not only ensure that the objectives of CDM are met but to also evolve a mechanism that endures beyond 2012.

CHAPTER IV

Emissions Trading in Brazil

Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen: The Stern Review 2006: 1

Introduction

Emissions trading allows the use of economic instruments for achieving climate change mitigation through financial incentives and penalties. Although emissions trading is a market instrument, it represents a unique type of welfare oriented market mechanism which combines governmental and inter-governmental decisions for reaching an environmentally optimal solution by using market forces to arrive at this solution in the least expensive way (Philibert 1999). This welfare orientation is achieved by emissions trading following out of the activities of sustainable development and mitigation oriented CDM projects or other approved and regulated mitigation activities[70].

The emissions trading scheme of the Kyoto Protocol created the 'carbon market' so named because the primary constituent of GHGs is carbon dioxide, thus placing the focus of mitigation efforts on carbon removal (UNFCCC 1997). Emissions Trading Schemes (ETS) have been sanctioned for use as climate policy instruments for countries by allowing them to create emissions obligations for public and private firms (UNFCCC 1997). It works by operating a cap-and-trade system in which an upper limit is set on the level of GHGs that can be emitted while simultaneously providing a release mechanism which gives firms flexibility in how they want to comply[71]. These limits are placed for participating firms in annex I or annex B countries but increasingly, non-annex I countries like Brazil have also experimented with similar schemes to fulfil *voluntary* commitments (Point Carbon 2012;

[70] For instance, REDD+ originating credits. There is more information on this later in this chapter.

[71] The two kinds of cap and trade scenarios are: absolute caps which limit the total emissions of a country or firms (placing different caps on the basis of nature of operations and size); and relative caps, which are emissions per unit of output or activity such as the consumption of energy or production of per unit of output.

World Bank 2011; World Bank 2010). Ideally, cap-and-trade programmes recompense innovation, timely action and efficiency with financial incentives while ensuring adherence to stringent environmental accountability standards that do not encroach upon economic growth (EPA 2012). For a non-annex I country like Brazil, emissions trading can serve as an important conduit of capital inflows and it can also stimulate economic growth (Philibert 1999). By offering a 'mutually beneficial… trading system' between developed and developing nations, emissions trading results in lowering abatement costs for climate change mitigation (Philibert 1999: 2).

Though 'tradable units' or 'carbon credits' include Removal Units or RMUs (related to land use, land-use change and forestry (LULUCF) activities such as reforestation), Emission Reduction Units or ERUs (generated through joint implementation projects and therefore not applicable from the standpoint of Brazil) and CERs (generated from CDM projects), there are other emission units such as Verified Emission Reductions or VERs.[72] While CERs, RMUs and ERUs are tools in the compliance market, VERs are tradable certificates in the voluntary offsets market. Compliance or regulated credit markets are created by obligatory national and international carbon reduction systems of governance like the Kyoto Protocol or the European Union- Emissions Trading Scheme (Kollmuss et al. 2008: 7). In the voluntary offsets markets, companies and individuals buy carbon credits to reduce their carbon footprint (Green Markets International 2007).

Carbon credits are tradable market instruments but the exact legal status of carbon credits has created a lot of uncertainty regarding their regulation in the Brazilian context. Carbon credits have been variously defined as commodities, bonds, intangible assets or securities (Marques et al. 2010). However, since they are neither tangible nor movable securities; paper currency; or funds of any type; carbon credits are not considered commodities (Souza 2008, quoted in Marques 2010). With approximately 20 bills waiting to be passed in the Brazilian Congress, all with different conceptions of the legal nature of carbon credits, the confusion regarding the status of the instruments is not likely to be resolved soon and there

[72] Since Brazil is a non-annex I country, the only Kyoto mandated carbon credit applicable to it is the CER. Other than Kyoto's emissions trading units, those applicable to Brazil (and enjoying healthy market conditions) are REDD credits and VERs.

are fears that this could possibly hamper greater engagement with the Brazilian carbon market.

One significant difference between the approach to emissions trading and the CDM is the temporal sequence of the two modalities. CDM is the activity that generates carbon credits to be used in emissions trading.[73] The two flexible mechanisms are linked modalities and therefore, the economic, social, environmental and welfare gains made by both the modalities are similar. There is another point of divergence between the two mechanisms and that variance is due to scope. Emissions trading is increasingly coming to accommodate carbon finance instruments that accrue through non-CDM projects as well. [74] These instruments are also carbon credits but they accrue from voluntary reductions projects or from forestry activities under the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation or the UN-REDD programme (Carbon Trading 2012). The heavily contested activity of avoided deforestation is included within the UN-REDD and REDD+ framework and has contributed to the earning of a significant number of carbon credits (UN-REDD 2012). These carbon credits are not only accepted within the international Emissions Trading Schemes (though not the European Union’s Emissions Trading Scheme or EU ETS)[75] but also have a demand domestically, in Brazil. They have also resulted in sustainable practices in the Amazonian Brazilian states that have implemented this programme. Of the 61 Brazilian companies that have earned carbon credits, Nova Iguacu-RJ was the first company in the world to earn carbon credits.

It is generally acknowledged that the REDD credits are representative of high quality emissions reductions and there is a demand for them in the voluntary credit markets even

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73 There are exceptions to this because emissions trading as it is understood today also includes non-CDM based project modalities. Though, all the activities that generate carbon credits are UN mandated and have the same objectives as the original CDM. Other carbon credits like VERs and REDD and REDD+ credits are briefly included in this chapter because of their important role in Brazil’s emissions market and the meaningful contribution to sustainability and environmental protection.

[74] This expanded scope is being adopted for the purpose of this study as well in global studies which research carbon markets.

[75] The EU ETS has been opposed to forestry credits from UN’s REDD programme since its inception in 2007. Its objections were based on its fears that deforestation credits would inundate the EU ETS market. It also had ethical concerns that allowing deforestation credits would allow companies in the developed world to pay off their mitigation obligations without actually bringing a concrete change in business practices.

those in Europe (Murray 2009). The demand for voluntary credits is not forced through government regulation and instead is driven by companies looking to fulfil their corporate responsibility to the environment (Carbon Retirement 2011).

The regulated market is often criticized on two primary grounds:

1. ***Firstly, it is believed to encourage end-of-pipe projects that earn a handsome return in the form of CERs but do not offer true mitigation potential:*** While in its original form, the Kyoto Protocol did not distinguish between the different projects, there are now regulations expressly forbidding the trade of CERs from certain GHG reduction projects. For instance, the European Union has ruled that credits from Hydroflourocarbon-23 (HFC-23) and Nitrous Oxide (N2O) projects are ineligible for emissions compliance use in the EU Emissions Trading Scheme. This is because credits from N2O and HFC-23 are not only relatively cheaper to generate, credits from HFC-23 earn almost twice the amount that directly selling a refrigerant gas like HFC-23 would fetch. This encourages the continued production of HFC-23 simply to allow producers the opportunity to destroy the gas to earn more money, as is seen in China (New Scientist Environment and Reuters 2007). In this scenario, emissions trading played the role of incentivizing the pollution of developing countries. One estimate shows that this loophole in CDM cost six billion US dollars in carbon credit payments where it would cost only one hundred million US dollars to reduce the pollution through technology transfers (New Scientist and Reuters 2007; Wara 2007).

2. ***Secondly, emissions trading is criticized because it could potentially be used as a mechanism for countries to completely renege on their mitigation commitments by purchasing credits for meeting the quantum of mitigation commitments****:* This however is a concern that can be put to rest with the inclusion of the principle of ‘supplementarity’ in the Kyoto Protocol. Supplementarity limits a party’s reliance on emissions trading alone as a means to meet its commitments (Ellerman and Decaux 1998).

True to its name, emissions trading proved flexible enough to bring important changes to its trading rules before more damage could be done.

Operation of the Emissions Trading Mechanism

As mentioned, under Kyoto Protocol's flexibility mechanisms, CERs accrue from verified CDM activities (UNFCCC 1997). After the registration process of the CDM project, the buyers can offer the CERs that are *expected* to be earned, to prospective buyers. This decision is based on market conditions, expectations about future prices and the availability of adequate buyers (Point Carbon 2012). However, the actual transaction of a carbon trading instrument (be it CERs or VERs) depends on the verification and certification stages which are a confirmation of the claims that the project did indeed generate 'x' number of GHG reductions, as claimed (UNFCCC 1997). Interestingly enough, the price of the carbon trading instrument does not depend on the project type but rather prevailing market conditions wherein the interaction of the forces of supply and demand for carbon credit determine a blanket rate for carbon credits[76]. Therefore, there is no premium on carbon credits earned from renewable energy projects which are more desirable from a sustainability viewpoint versus those earned through end-of-pipe fixes. So, while the quantity of CERs varies depending on the type of project, technology used, kind of GHG mitigation achieved or national and sectoral regulations, the price level fixed will be based on macro market conditions (Patel 2006).

[76] There are other factors besides the demand and supply though, as will be discussed later on in this chapter. Banks, financial institutions and funds employ methods to keep prices artificially low in many instances. In many cases the end users of the credits (companies in countries with GHG reductions commitments) aren't the ones who directly purchase the credits from the sellers, instead they buy them from intermediary companies that sell these credit instruments at a higher rate.

Table 4: Global Issuance of CERs for CDM Projects

Project Type	Number of Projects	CERs Issued (in thousands)
Wind	2442	225194
Hydro	2261	307090
Biomass energy	901	60797
Methane avoidance	776	35144
EE own generation	483	63889
Landfill gas	424	64752
Solar	312	10736
EE Industry	164	7549
Fossil fuel switch	152	69634
Coal bed/mine methane	113	71817
EE Supply side (power plants)	113	61993
EE Households	109	4121
N2O	106	57696
Afforestation & Reforestation	68	3289
Fugitive	65	47176
Cement	50	7743

Source: UNEP Risoe 2012

The Voluntary Market

Activities that generate VERs are similar to those that earn CERs, i.e. renewable energy, energy efficiency, methane capture and forestry. These VERs are certified by some of the most meticulous certification standards such as the Voluntary Gold Standard, the GHG Protocol for Project Accounting and the Climate, Community and Biodiversity Project Design Standards (Kollmuss et al. 2008; Green Markets International 2007). VERs are more quickly maturing carbon market trading instruments which can be utilized effectively for small projects which are already operational (thus, bypassing the often expensive, long and circuitous route of CDM registration). VERs support inclusive development because project activities that are issued VERs often have a strong element of sustainability (Patel 2006)[77]. There is an even greater emphasis on achieving sustainability goals for VERs than with CERs. These sustainability goals are oriented around local community development and range from the provision of enhanced access to education and healthcare, improved employment opportunities and social benefits (INSEDA 2007).

VERs also represent a more inclusive system of participation because voluntary markets allow unregulated sectors and non-annex I countries to participate in the global carbon market. The voluntary market is a valuable source of experience in emissions inventory management and emissions reductions for firms in Brazil and the flexibility it allows enables the crediting of small, niche projects with limited financial backing (Kollmuss et al. 2008). Even though VERs sell for significantly lower rates in the carbon market, there are very low transaction costs and usually a direct seller to end-user relationship that can be established.

Record transactions were observed for voluntary markets in the year 2010. Even though they account for only 0.3% of the total volume of emissions trading, the voluntary market has grown 28% between 2009 and 2010 (The World Bank 2011). It is responsible for trade in carbon credits worth 131 million tons of carbon dioxide equivalent (MtCO2e) worth approximately $424 million (Hamilton et al. 2010). This increase in carbon credit sales has been due to the sought-after forestry credits from REDD programmes which have accounted for a 500% increase in market share. With the interest expressed in REDD by the Californian market, Brazil too has seen a rise in domestic mitigation 'experiments' with utilizing REDD credits. The World Bank (2011) attributes the credibility of REDD to the

[77] For this chapter, the processes explained, barriers and recommendations are specifically for UNFCCC's CDM and the resulting CERs unless specifically stated. Considering the versatility of instruments available for emissions trading in the carbon market, only the major emission trading units have been mentioned.

use of stringent methodologies to earn credits represented by the Verified Carbon Standard and Brazil's Brasil Mata Viva (BMV).

The voluntary market also represents a purely voluntary (and perhaps, altruistic) motive behind transactions and it is estimated that about 70% of the buyers are not driven by any profit motive but only a desire for being linked to carbon mitigation programmes that offer genuine sustainability (The World Bank 2011).

Creating a National Emissions Trading System in Brazil

In the global carbon market, Brazil's share of emission credits has been approximately 5% (HSBC 2010). It is estimated that the value of Brazil's CERs already exceeds 6 billion euros per year. The value of the CERs is determined by pegging it to the European Carbon Market (Cavalcanti 2012). This valuation is tempered by the energy market taking into consideration commodity valuations for oil and gas. Considering this degree of interconnectivity with the global emissions trading markets, it should be just a matter of time before Brazil creates a federal Emissions Trading System or national carbon market. Another argument in favour of developing Brazil's national carbon market is that that it is an important step to increasing Brazil's share in the carbon market and encouraging the attainment of Brazil's national voluntary GHG reduction goals which were announced in 2009 (World Bank 2010). However, creating a globally linked national carbon market requires certain institutional and regulatory prerequisites. The requirements for the development of a national carbon market are: creating a reliable, regularly updated national database categorizing the various emissions reductions projects that are available (World Bank 2010). This will give project developers the opportunity to analyze the CDM project opportunities available to them and implementing those that give them maximum returns within the resource endowments (finances, time, expertise, technology) they possess (BM&FBOVESPA 2010).

Low carbon investments that are robust enough to encourage a significant reduction of GHG mitigations require the establishment of a smoothly functioning global carbon trading system. This is because carbon mitigation isn't a unilateral goal that can be achieved within a self contained, autarkic system. While there are some sophisticated regional emission trading systems (ETS) like the EU ETS and sub-national systems like the Brazilian Bolsa Verde do Rio de Janeiro, the ultimate goal of an effective ETS as under Kyoto Protocol is a harmonized international market (Sterk and Mersmann 2011). Such a market would have the capacity to seamlessly link demand and supply across the globe and would work out issues such as ‘coverage of the scheme, definition and recognition of trading units, type and stringency of emission targets, allocation methodology, temporal flexibility, MRV, and compliance systems’ (Sterk and Mersmann, 2011: 1). One vital requirement of a harmonized international market is that the same quantitative units of trading should ideally be used across the board. However, Brazil’s adoption of a wide range of trading instruments, given the success they have enjoyed, is likely to prove problematic. If a certain unit of trading is not recognized (like avoided deforestation credits) by all trading schemes, those credits can then be used by Brazil for fulfilling voluntary commitments. Pegging the exchange rate of the various credit instruments to the CER (akin to the valuation of currencies which are pegged to the US dollar) would help trade but it would also increase costs without offering tangible benefits given the infancy of the carbon market.

Table 5: Top Countries in Terms of the Issuance of CERs till 2012

Top countries by issued CERs	**MCERs** (Million CERs)	**Share**
China	573.6	59.8%
India	142.8	14.9%
South Korea	89.0	9.3%
Brazil	69.7	7.3%
Mexico	15.7	1.6%

Source: UNEP Risoe 2012

Legislation and Institutions for Emissions Trading in Brazil

Brazil’s National Policy on Climate Change as instituted by Law no 12.187/09 gave official sanction to the creation of an emissions trading market as a valid tool for enhancing climate change mitigation. In the absence of a federal carbon market, an alternate carbon market known as the Brazilian Carbon Market (MBRE) was created by the BM&FBOVESPA and the Brazilian Ministry of Development, Industry and Foreign Trade. The MBRE grew out of the need to develop a trading system in accordance with the requirements of the Kyoto Protocol, which would allow trading in environmental certificates (BM&FBOVESPA 2012). This market works by holding internet based carbon credit auctions which are made available to participants of the global carbon market. The MBRE is a stock exchange for voluntary credits like VERs as well as CERs. This collaboration between the public-private sectors serves as a model of streamlined carbon market development and carbon governance. The private sector in this case has been instrumental in providing expertise in the field of carbon trading and also amending the lapses in implementation by the Brazilian government (Baker and Mackenzie 2010). Internationally, these carbon credits are traded at stock markets in places like the Chicago Climate Exchange and in Brazil in the MBRE (Cavalcanti 2012).

The other proposed legislation related to carbon markets in Brazil are bill nos 493/07, 494/07, 594/07 and 1.657/07 (BM&FBOVESPA 2010). Once these bills are approved, they will establish Investment Funds in CDM Projects which will help raise funds specifically designated for use in CDM projects. Through all of this, Brazil's DNA, the CIMGC, will be responsible for the regulation of any new provisions or institutions related to carbon markets and CDM projects. It is the Brazilian Securities and Exchange Commission which is responsible for creating rules related to emissions trading.

The implementation of the MBRE took a long time even though it was envisioned as a privately run stock exchange because of regulatory and legal aspects that have not been clarified by the Brazilian government yet (World Bank 2010). However, of late there has been a revival of interest in creating a carbon market in Brazil beginning with the state initiatives which will hopefully expedite legislation related to carbon market regulations.

Rio de Janeiro decided to launch an emissions trading scheme on a pilot basis for its largest domestic polluters in December of 2011 (CMI 2011). Known as the Bolsa Verde do Rio de Janeiro (BVRio), it became Brazil's first government-backed carbon trading scheme which follows the cap-and-trade format. The pilot stage for its first legally binding period for private entities is a two year period from 2013 to 2015 covering the chemical, petrochemical, cement, oil, gas and steel sectors (World Bank 2012). This pilot stage is to be succeeded by three five year phases, indicative of an optimistic view of the domestic emissions trading market (Point Carbon 2012). The hope was that BVRio would serve as replicable model for other states that would allow the linking of different state emission trading schemes eventually creating the basis of a Brazilian national scheme (CMI 2011). Sao Paulo's 2009 target to reduce GHGs 20% below 2005 levels by 2020 has already prompted it to explore emissions trading as an additional mechanism to promote compliance with mitigation targets. Sao Paulo has planned to launch Brazil's largest emissions trading scheme which could potentially be linked to the one in Rio de Janeiro (Point Carbon 2012). Sao Paulo had 57 of the largest Brazilian companies already committed to voluntary GHG emission reductions as of 2011 (World Bank 2012).

Other supporting institutions for the operation of a domestic emissions trading system in Brazil is the Brazilian Carbon Facility which was established by the Brazilian Mercantile and Futures Exchange and the Brazilian Ministry of Development, Industry and Foreign Trade in 2005 (Chapman 2011). The Brazilian Carbon Facility is a non-governmental facility creating a registry for the purpose of connecting potential investors with carbon related project developers (Baker and McKenzie 2010).

Theoretical Concerns

This section summarizes a few key theoretical underpinnings to the emissions trading modalities. The emphasis is on those aspects which can facilitate the operation of the carbon market and effectively lower prices.

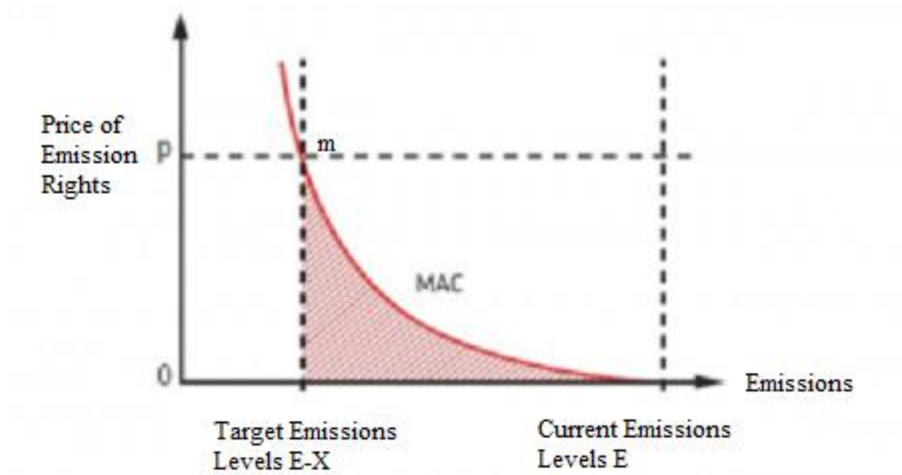
1. Focusing on the Industry rather than the Government:

The biggest 'carrot' offered by emissions trading is the reduction of marginal abatement costs for switching to cleaner sources of fuel or alternative green technologies from cheaper albeit polluting carbon intensive methods. Since it is industries (including individuals, firms and traders) who have more complete knowledge of prices and market conditions, being the actual players in the market, it is they who should be involved in emissions trading activities and not governments (Bohm 1998). Therefore, for emissions trading to be successful it is imperative that the marginal gains (in terms of medium term to long term savings) should accrue to these firms and that participating firms be made aware of the advantages of emissions trading (Bohm 1998).

Another reason for the focus on industries is the assumption that industries behave rationally and in a manner that helps them maximize profits while minimizing costs; not a fashion in which governments generally operate considering they have welfare motives to look after as well. Therefore, by the same rationale, if emissions trading gives industries the opportunity to offset costs or lower marginal abatement costs there will be greater participation in the carbon market by them.

Since one of the key tools of cost analyses for both industries and government (in the context of emissions trading) is marginal abatement costs, this section will briefly deal with their graphical representation, Marginal abatement curves (MAC). MACs help determine the potential advantages of emissions trading for parties and the probability that they will participate in emissions trading (Ellerman and Decaux 1998). They also help determine the demand and supply for emissions credit units in the market (Ellerman and Decaux 1998). Here is a simplified graphical representation of how MACs will decrease for industries participating in the carbon market:

Graph 2: Marginal Abatement Curve



Adapted from: Roberts 2011

The graph is a simple marginal abatement cost curve. This curve illustrates the environmental economics view that imposing prices on carbon acts as a deterrent to GHG emissions. This is also a price-effective way to compel industries and countries alike to mitigate carbon. The curve illustrates this in two ways: firstly, it shows that carbon pricing increases overall costs for firms, thus making it preferable for them to adopt (first the cheapest means) cleaner modes of production; secondly, it shows how after a while of investing in clean technology, the total costs for firms come down because they 'institutionalize' clean and efficient production techniques. The y-axis shows the prices of emissions rights with the x-axis showing the total level of emissions. The ideal price of emissions penalties or credits is set at the point , m, where the curves intersect, illustrating the equilibrium between the demand and supply. Thus, prices of emissions are set depending on the amount of emissions reductions desired.

Without the penalty of carbon pricing (or emissions trading modalities), the firms would have no incentive to switch to clean technology because it would represent increased prices for them. However, the penalty imposed by carbon prices is sufficiently high enough (in theory at least) to cover and exceed any gains the industries would have had from continuing with their previous production preferences.

2. Normative and Positive Issues with Emissions Trading in the Brazilian Context

The Role of Emissions Trading in Reducing Abatement Costs and Fostering Inclusiveness

A purely market based mechanism is akin to a business transaction promoting an unfavourable balance of payments with developing countries bearing disproportionate costs. In such a scenario, abatement costs for developing nations like Brazil can actually rise. However, if moderated by a genuine concern for welfare and respect for social goods, market instruments foster collaboration between the developed north and developing south encouraging low cost, efficient, politically expedient solutions for climate change mitigation (Criqui and Viguier 2000; Wilkins 2002; Morsink et al. 2011). There are more gains to be accrued with the inclusion of a diverse set of stakeholders and not merely the host country. This inclusion is expedited with the inherent interconnectivity that markets foster. By using a nationally appropriate mitigation strategy centered around CDM and emissions trading projects, not only can mitigation costs come down but multiple objectives of community involvement, ecosystem protection and sustainable development can be achieved as well (Skutsch 2004; Grace et al. 2003).

The Role of Emissions Trading in Reducing Climate Related Externalities

Without the climate related obligations imposed by the UNFCCC's Kyoto Protocol, there is a high probability that countries would choose to continue in a business-as-usual manner. This is because greenhouse gases and climate change are externalities with their effects felt only in the long term (Conejero and Farina 2003). Conejero and Farina (2003) understand externalities as an occurrence that takes place due to the inefficient allocation of resources which results in social costs that far outweigh the private costs incurred. These externalities are characterized by their affect on the utility of an entity situated outside the exchange relationship. The solution to this problem is to internalize costs for polluters through taxes, with regulations like rules or fines, or with penalties imposed in the form of a cap-and-trade scheme requiring polluters to pay compensations through the purchase of carbon credits (Conejero and Farina 2003). Adverse externalities like the ones related to this example are a sign of inefficient investments and a solution like the creation of a carbon market can actually benefit the firm as well by forcing it to adopt an efficient means of production. While the costs for private parties will never be as high as the social costs which are long term and intergenerational, stiff financial repercussions will decrease the profit incentive that induces pollution—heavy, carbon intensive methods of production. Ronald Coase (1960) also demonstrated how the operation of free markets can lead to improved economic efficiency and in the case of carbon markets, the tool for achieving this efficiency is transaction costs.

Enhancing Conceptual Clarity in Emissions Trading for Making Sustainability Gains and Enhancing Market Efficiencies

The lack of specific rules regarding the taxation and accounting of trading and creating carbon credits is a regulatory issue that has caused confusion over carbon trading (Castro and Michaelowa 2007). There is silence on the treatment of carbon credits from the Brazilian Reserve Bank, the Internal Revenue Service of Brazil and the other institutions that help shape accounting practices in Brazil. The issues resulting from this regulatory uncertainty range from the status of carbon credits in company balance sheets, the costs of these credits (in the absence of a uniform tax code that is specifically applicable to them), and temporal issues related to when the credits should be deemed to have accrued to a company (BM&FBOVESPA 2010). In the last instance, the time of credit generation could be the registration of the project since the PDD specifies an estimated number of CERs or the verification of the project which could mean a difference of a few years. For buyers, if there is a pre-existing agreement (an Emission Reduction Purchase Agreement) with the sellers (as is common in the case of CERs in joint projects and VERs) there can be inconsistencies between different accounting practices rendering significant differences in when the CERs are shown as acquisitions for the companies.

The importance here is that for companies with reduction commitments, carbon credits play a significant role in their ability to comply with requirements. For instance, the European

Union Emissions Trading Scheme (EU ETS) penalizes participating entities with fines (which are significantly higher than the value of credits) if they exceed their emissions quotas and do not purchase credits to cover the exigencies (EU 2012). If the credits are shown as purchased at a time when they weren't needed ie; when the entity complied with the targets; then it will result in a loss for the buyer.

In the case of some sellers (project developers), carbon credits are listed as long term assets depending on when they are actually utilized (BM&FBOVESPA 2010). In such a case the costs of the CDM projects are treated as an immediately deductible expenses or costs related to the formation of intangible assets (carbon credits) and in such a case the costs are amortized or decreased over a period of time till the time they are purchased.

The Role of Taxation in Emissions Trading

Chapman (2011) suggests that the emissions trading infrastructure can work as a capacity building tool in the market which has positive externalities for all firms once the carbon market reaches a stage of maturity. If emissions trading instruments like CERs are also made taxable (with taxes such as to turnover tax, corporate tax, withholding tax, capital gains tax or financial tax levied on remittances of funds derived from emissions trading) with the taxes being used for mitigation projects or sustainable development projects, there will be a guaranteed incentive for states to create a strong carbon market (Chapman 2011).

Taxing CERs can also correct market failures arising out of the misuse of emissions trading by firms to renege on their mitigation commitments (Chapman 2011). Marques et al. (2010) have been of the opposing view and believe that taxation can be a double edged sword when it comes to carbon credits. One uniform regulatory tax is all that is required to encourage the proliferation of carbon trading in Brazil, all other taxes on CER transactions should be removed for the sake of operational simplicity (Marques et al. 2010).

Some see the CERs as the equivalent of a right to pollute. Therefore, in accordance with the principle of 'polluter pays' those who purchase credits should be the ones to pay taxes (Santos and Ribeiro 2009). Thus, where issuing CERs alone doesn't adequately or convincingly address mitigation issues, the taxes on CERs could play a novel role in achieving mitigation and social justice. Provided, of course, that Brazil were to actually place the revenue from CER taxes into a special fund made expressly for the purpose of achieving sustainable development goals (especially those in the project area for the CDM projects from which the CERs originated. This would require a meticulously maintained registry or inventory of carbon credits and the different hands exchanging the carbon credits. [78]

Case Studies, Benefits and Diagnostics for the Brazilian Carbon Market

Cap and Trade is a more effective mechanism to achieving compliance with environmental goals and the Brazilian government recently released plans to cap greenhouse gas emissions in the three sectors of industry, mining and transportation (Teixeira 2012). Gustavo Loyola, the former president of Brazil's National Bank, Banco Central do Brasil, also asserted that cap and trade systems would play a crucial role in lowering emissions in Brazil (Shankleman 2012). There are also plenty of opportunities for low carbon projects in Brazil with the potential for yielding more CERs lie broadly in the fields of energy, forestry transportation, management of waste and industrial treatment of by-products. Forestry is included in this mix of projects despite the low yield of afforestation/reforestation (A/R) CERs and the regulatory ambiguity regarding the future of avoided deforestation (the most promising CER earner) in future negotiations[79]. Also, considering the resource intensiveness, spatial constraints and length of time required for implementing A/R projects, they tend to not be very popular (World Bank 2010). However, it is important to note that there is plenty of scope for forestry activities in emissions trading and a CDM project in the state of Minas Gerais was the first to earn carbon credits for a forestry project. The project was issued four million Temporary Certified Emissions Reductions (tCERs) which represent

[78] This is because it is quite common that the end user of carbon credits isn't the first buyer. Sales are usually arranged through large intermediaries like the World Bank, which incidentally keeps the price of carbon credits artificially low as well.

[79] This analysis is only limited to CDM forestry projects and not REDD projects.

the total amount of sequestered carbon since the project's inception. These tCERs are issued at each commitment period of the project, at the expiration of which these credits must be renewed (Bird et al., 2004). The Sustainable Amazon Foundation (FAS) reported that the total value of carbon credits that could be earned from 34 protected areas of the Amazon could reach $ 100 million per year (BM&FBOVESPA 2010).

The Bolsa Verde do Rio de Janeiro ETS launched a new kind of credit market related to forestry in 2012 which could be used as a compliance tool for Brazil's Forestry Code (Shankleman 2012). Since the code requires farmers to keep a minimum level of forest and vegetation growth on their land, those missing the minimum legal requirement could buy carbon credits from those who exceed the criteria. This has come on the heels of the changes made to the forest act of Brazil which in a way reprieves landowners who cleared their forested land illegally till the year 2008. Thus, the timing of the Bolsa Verde do Rio de Janeiro ETS forest carbon market is propitious and could help mitigate some of the damage of the regressive, environmentally harmful legislation represented by the amended forest act (PWC 2012). With the creation of this forest carbon market, Brazil is emulating the United Kingdom in developing a carbon scheme that promotes economic development with environmental protection (Forest Carbon News, 2012).

In the case of Minas Gerais, the forestry related CERs earned have helped it promote environmentally sustainable industrialization in the iron and steel sectors (World Bank 2012). The state has been encouraged to use renewable charcoal through sustainably managed tree plantations for fuel purposes. These plantations achieve their mitigation objectives through carbon sequestration and provide charcoal which is carbon neutral (Project 0151 PDD 2007). There are only two purely forestry related CDM projects for Brazil listed in the UNFCCC CDM project registry. However, there are actually a total of 14 CDM projects in Brazil which are eligible to earn carbon credits with forestry, afforestation or reforestation as some of the primary supporting activities[80]. For instance, the Juma

[80] Not all CDM activities are registered under the UNFCCC or even included in the CDM registry of the UNFCCC even though they comply with the same guidelines as set out under the Kyoto Protocol and Marrakesh Accords. There are other CDM inventories and carbon credit validating entities such as the Gold Standard or the Forest Carbon Portal.

Sustainable Development Reserve in the state of Amazonas and the Carbon Fix project in the Amazon region.

Public and private sector development of CDM projects in Brazil's Acre state aimed at slowing deforestation has a potential for producing up to 48 million carbon credits over a period of eight years (Volcovici 2012). In fact, these carbon credits have contributed to a 60% increase in the carbon offset market in North America and is responsible for a very stringent implementation of Brazil's environmental policies in this area which possesses 7.4 million hectares of forested areas under protection (Volcovici 2012). Acre is also selling carbon credits to the state of Chiapas in Mexico. Acre has 7.4 million hectares of forested areas under protection, and is considered amongst Brazil's most proactive states regarding the generation of carbon credits. The impetus to Acre's lively carbon market is due to two reasons: the 2010 law in Acre which created the System of Incentives for Environmental Services (SISA) which promoted the commoditization of carbon for promoting forest based carbon abatement activities; and the establishment of a REDD + Policy (World Bank 2012).

The State of Acre has also acknowledged the importance of carbon finance in mainstreaming indigenous communities. In an attempt to implement economic and social welfare programmes that encourage development in a region that was otherwise in an impoverished part of the Amazons, Acre has initiated and implemented a number of programmes that have put it in the enviable position of having the most profitable carbon credit programmes in Brazil (Shankland 2011; World Bank 2012). It also created the Promotion and Environmental Services Enterprise which was a 'public-private partnership aiming to develop local capacity through the establishment of domestic and international networking' and it has also participated in the Governors' Climate and Forest Task Force (World Bank 2012: 96).

The concept of 'avoided deforestation' has previously been introduced in chapter two regarding the state of Amazonas support to particularly those CDM projects that are concerned with avoided deforestation (AD). While the Kyoto Protocol's conventional brand of CDM does not recognize AD as a legitimate CDM activity, the United Nation's

Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation does allow AD projects to earn carbon credits. [81] Brazil's REDD programme has been quite successful and in 2012, Bunge Environmental Market's AD programme is set to earn approximately 800,000 voluntary carbon credits thus, reducing 800,000 tonnes of carbon dioxide equivalents per year. Voluntary Carbon Credits (VCC) are issued under the REDD's Voluntary Carbon Standard programme (Texeira 2012). While VCCs aren't accepted for trading in the EU ETS, there is acceptance for these credits in the domestic markets of some developing countries. Also, within Brazil there is already demand for VCCs which are more affordable than CERs which are the conventionally used carbon credits.

Considering the slew of legislation promoting renewable energy in Brazil and the accompanying CDM projects, there should be a corresponding number of CERs earned for these projects. However, renewable energy projects suffer from a lower mitigation potential given the high amount of clean technology already utilized in Brazil. Comparative gains in energy efficiency projects are significantly lower when the baselines are so high to begin with compared with the gains seen in economies which use carbon intensive fuel. The lower mitigation potential translates to fewer CERs being earned by a project which has the tendency to constrain investments from abroad. Chapman (2011) suggests that when this happens, domestic investment, which is driven by criteria other than just CER yields, could step in to invest in renewable energy projects. Also, armed with local knowledge and special expertise regarding the project's requirements, domestic investors could earn more CERs by improving the mitigation capacity of renewable energy projects (Chapman 2011). This would have the effect of strengthening the local credit market and building the momentum for creating more state emission trading systems.

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81 Reducing Emissions from Deforestation and Forest Degradation (REDD) is 'an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development.' (Source: UN-REDD website: http://www.unredd.org/AboutREDD/tabid/582/Default.aspx).

The potential of converting landfills into profitable CER earning CDM projects has not escaped the notice of the Brazilian government. In the wake of successful projects converting landfills into GHG capture sites like the ‘Bandeirantes Landfill Gas to Energy Project’, the ‘Manaus Landfill Gas Project’ and the ‘Sao Joao Landfill Gas to Energy Project’ the government is keen to convert its largest landfill, the Gramacho landfill in Rio de Janeiro, into a CDM projects (Reuters, 2012. The three landfill projects listed above accounted for more than 2919160 carbon credits but once registered, the Gramacho plant alone will generate 900000 carbon credits per year for a period of 7 years (Reuters 2012). [82] Besides earning carbon credits through the capture of methane emissions, the Gramacho project will also help produce clean energy in the form of biogas which will be provided to Brazil’s national energy grid (Point Carbon 2012).

The Domestic Market for Carbon Credits in Brazil

In the wake of the financial crises of 2009 and the ensuing market instability in Europe, the carbon markets have suffered for want of adequate demand. The demand for CERs from Europe in the next commitment period from 2012 is expected to be slim because of Europe’s decision to place a higher cap on allowed emissions, allowing those with mitigation commitments to gain surplus allowances (World Bank 2011). Also, a major change in offsetting rules for EU says that for projects registered after 2012, only credits from least developed countries are eligible for offsetting. This doesn’t apply for the voluntary market as of now (World Bank 2011). The surplus generation of carbon credits can easily be swept up by developing countries like Brazil with voluntary commitments.

Domestically traded carbon credits are expected to get increased importance in the next few years given Brazil’s keenness to show its commitment to climate change mitigation by announcing voluntary targets. With the urbanized and industrialized states in Brazil’s east and south-east being faced with a higher mitigation burden, unilateral climate mitigation actions and even CDM projects may not be enough to meet their targets. In this scenario, it is more prudent for states like Rio de Janeiro and Sao Paulo to buy carbon credits, especially

82 One CER equals the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases (Cantor CO2 web site).

those sourced domestically. Also, though these states do not have sectoral plans targeting their industries yet, once these targets are imposed it won't be possible for an industry or sector to immediately adopt clean energy practices. Therefore, in the interim period, till the acquisition of training, technology and a clean development plan isn't operational these industries will have to buy carbon credits.

The state of Sao Paulo's sincere ambitions to reduce GHG emissions has also manifested in one of the few (till now) regional government purchase agreements for carbon credits. In fact, Sao Paulo has been in talks with the state of Acre to buy forest based carbon credits to meet its voluntary targets of reducing GHG emissions to 98 million tonnes of CO2 equivalent in 2020 from 122 million tonnes in 2005 (Point Carbon 2012). In an act that will help set the template for the eventual integration of Sao Paulo's carbon ETS with Rio de Janeiro's, Sao Paulo and Acre have started working on a set of modalities to integrate Sao Paulo's climate related legislation with Acre's environmental services system (Point Carbon 2012).

Today, Brazil exploits 30% of its hydropower potential, with the remainder less competitive, owing to its location within the Amazon, far from demand centres, resulting in cost increases from transmission and power losses (Cole and Liverman 2011). With the incentives provided by a carbon market, where CDM hasn't made much headway, perhaps the incentives of a well regulated domestic carbon market with a minimum support price will incentivize developers to launch at least hydroelectric projects. Companies are expected to continue to purchase CERs because of the motive of corporate responsibility. If nothing else, the attention showered on the Kyoto Protocol since COP-15 in Copenhagen has brought enough focus to the environment to compel organizations to consider green tech or environment friendliness as a competitive advantage.

Sustainability Aspects of the Carbon Market

Not only are carbon credit instruments a potent financial inducement for Brazil, they also serve a very important means to an end. Carbon investments sourced through emissions trading are used as a bait to encourage clean technology investments where the novelty of the technology leads to increasing returns on investment for financiers initially (BM&FBOVESPA 2010). Emissions trading acts as a catalyst for investing private finance into clean technology by subsidizing investments in climate mitigation projects through carbon credit finance (Point Carbon 2012). The increase in voluntary carbon markets also marks a change from the earlier tendency for companies to engage in pre-compliance buying in anticipation of climate change legislation enforcing cap-and-trade systems. The surge of REDD activity has resulted in credits almost reaching twice the previous levels of CDM credits in Latin America, which has also given a boost to project developers who've now noticed an enhanced potential for climate mitigation projects even in areas that were earlier seen as unprofitable (Hamilton et al. 2010). Analysts believe that this is also laying the grounds for long-term growth in developing countries like Brazil by encouraging development in oft-neglected sectors (Hamilton et al. 2010).

Another means of achieving sustainability objectives through the use of carbon credits is for a 10% taxation on buyers under the CIDE tax (the Contribution for Intervention in the Economic Domain or the Contribuição e Intervenção no Domínio Econômico). This is a fund of sorts which acts as an intervention in the financial and economic domain which is paid for by taxing royalty payments, technology transfers and compensation of technology supply, and technical assistance (Novais 2011). This could then be used to fund environmentally sustainable projects.

Conclusion: The Future of Emissions Trading

The last few years beginning 2009, have witnessed a decline in the emissions trading system. The CDM market has contracted by 46% to US$1.5 billion which is the lowest level since the entry into force in 2005 of the Kyoto Protocol (World Bank 2011). While primary CERs (from CDM projects) has shown a decline in demand, there has been more responsiveness to Assigned Amount Units and secondary CERs (VERs and those derived from REDD).This decline is due to several factors ranging from the deadlock over negotiations about a post-Kyoto regime, confusion and uncertainty about emissions trading systems after 2012, the lack of new legislation mandating cap-and-trade schemes in developed countries, and concern about the financial recession that the world is still facing which has had the unfortunate effect of withdrawing international political commitment to the Kyoto Protocol (World Bank 2011). Recession in the industrialized world also meant a reduction in industrial output levels which led to lower GHG emissions and reduced emissions compliance requirements in a bid to increase output.

Conventional emission trading may be winding down for now, but till the UNFCCC COP 18 in Qatar, no final verdict can be delivered. Emissions trading is enjoying a revival through the voluntary market. While it may not be in the exact form as envisioned in Kyoto Protocol, it does represent an evolution of the Kyoto Protocol's flexible mechanisms to adapt to a changing world. The voluntary carbon market in Brazil represents approximately 60% of the voluntary credits in Latin America and if in the future emerging economies like Brazil, China and India do agree to mandatory GHG reductions, these voluntary markets could just as easily remodel itself to a compulsory compliance facilitating carbon market. Brazil has already developed two certification programmes for carbon credits--the Social Carbon Standard and the Brasil Mata Viva (World Bank 2012). Brazil's notorious lack of clarity on CDM CER regulation has not been replicated with voluntary credits. This is thanks to the effort of private organizations like the Association of Standardization which developed rules and regulations for governing VER voluntary transactions (ABNT 2012). These private initiatives have the advantage of being more aware of the lapses in the system that private companies interested in developing GHG mitigation programmes face. The Association of Standardization started a capacity building programme aimed at assisting small and medium scale enterprises to invest in clean projects and carbon opportunities (ABNT 2012).

Brazil's continued support of the Kyoto Protocol's flexible mechanisms and its commitment to voluntary actions (which it followed up with its state emissions trading systems) has been affirmed in its submission to the United Nations Framework Convention on Climate Change (UNFCCC) where it maintained that it would continue its voluntary emission reductions measures. Therefore, regardless of the future of the Kyoto Protocol in the wider international community, Brazil's allegiance to its carbon market has been secured.

The value of emissions trading must not be negated in the light of recent global trends. As demonstrated by Ellerman and Decaux (1998), any form of emissions trading—regardless of the constraints it operates in—is better than no trading; and even though the gains from emissions trading are unevenly distributed because of the relative advantage that Brazil has in lower abatement costs in the region, the gains from trade for Brazil are significant. Therefore, to return to the quote at the beginning of this chapter, if climate change is the biggest market failure the world has ever seen, it is also responsible for creating the biggest market opportunity with a conscience.

CHAPTER V

Conclusion

The primary aim of this dissertation was to study the operation and mitigation potential of the Kyoto Protocol's Clean Development Mechanism (CDM) and emissions trading mechanisms in Brazil and to analyze the complementary roles played by Brazil and the Kyoto Protocol in achieving mitigation goals. Considering the global loss of momentum in re-negotiating the CDM, another objective of the study was to determine whether or not Kyoto's market mechanisms are worth the effort and resources that will be required for future re-conceptualizations and negotiations. To get a clearer picture of the benefits, opportunities and shortcomings of the mechanisms, the approach adopted for this study has been to incorporate a more holistic view of the CDM (and to a lesser extent, emissions trading) in Brazil which included sustainability benefits. Another aspect of CDM and emissions trading that was studied were the enabling factors in Brazil and the various barriers faced in implementing these mechanisms.

This dissertation explored the synergistic relationship between Brazil's climate oriented national policies, the unique mitigation opportunities in the country and the international climate change regime as specifically embodied by the flexible mechanisms of CDM and emissions trading. This synchronicity has been the key force that has driven Brazil's success with these flexible mechanism modalities. The descriptive and analytical approaches were used to study Brazil's experiences with CDM and emissions trading, with an emphasis on CDM as it forms the vital prelude to the pure market orientation of emissions trading. The CDM was analyzed with a focus on its mitigation potential and sustainable benefits and the preliminary result of the study has been rather heartening. Considering the inherent complexity of adequately defining sustainability, there was no specific hypothesis framed regarding sustainability benefits. However, considering its importance in long-term capacity building, the sustainability analysis of CDM projects over a range of six different sectors—

hydroelectricity, wind energy, forestry, methane avoidance, landfill gas and energy efficiency—was conducted. The sustainable benefits include mitigation, the generation of clean energy, the creation of employment opportunities, local community development, sustainable green plantations, investment in public welfare activities, climate advocacy and so on.

Brazil's engagement with the international climate change community has generally been a receptive and collaborative one. Its proactive commitment to the construction of the global climate regime has been visible since the first Earth Summit in Rio in 1992 which was followed up by Brazil's most valuable contribution to the Kyoto Protocol, the Brazilian Proposal, which is the predecessor of the CDM. Brazil's support of collective climate action has transcended mere lip service and has often been backed by concrete national actions. This is also the reason why the flexible mechanisms have been so successful in Brazil—national actions are an effective psychological lure to investors; people who are often driven by perceptions. The flexible mechanisms are proof that international policies are not merely instruments of grandiose rhetoric. Given more time, and more focused commitment, a reformed CDM and emissions market can elevate climate negotiations from an expensive international consortium—that often inflames into an incendiary war of words between two opposing camps—to a mutually inclusive, humanizing and constructive process. In fact these mechanisms can be effectively employed as key interventions in the early to medium stage of a country's adaptation and mitigation programmes.

In spite of Brazil's enviable history and experience with innovative regional and grassroots technology, the flexible mechanisms' market orientation has played a significant role in supporting these home-grown climate related interventions. Contrary to popular opinion, the market has not over-reached its mandate and has instead actually contributed to the attainment of Brazil's social welfare goals. The purpose of this large scale (and at times, labyrinthine) exercise has been to create a global network which is mutually beneficial. To appropriate the Gaia hypothesis, which employs the metaphor of the earth as a large integrated living organism, in the age of globalisation the international system with its constituents of nations and international institutions too are like one contiguous living system in which global and national events and actions have unavoidable effects on each other. Therefore any corrective action for reversing climate change necessarily requires that the international system (the brain) work in tandem with national governments (the organs).

Finally, to summarize this relationship between the international relationship as represented by the Kyoto Protocol and Brazil's national policies and regional endowments, this dissertation has demonstrated that the flexibility mechanisms have succeeded in the Brazilian context because of the following enabling factors:

1) It is highly likely that in the absence of Brazil's institutions, regulations and infrastructure, the CDM would not have succeeded to the degree that it did.
2) Brazil's enthusiastic support and micro-engagement with the multilateral climate negotiation process has played an important role in the acceptance of the CDM and emissions trading.

The study posed three hypotheses to explore Brazil's quality and depth of engagement with Kyoto Protocol's flexible mechanisms.

1) The first hypothesis is framed as two complementary scenarios which mirror the mutually reinforcing relationship that has played out between Brazil and the CDM.

Brazil's participation in the CDM has been enhanced by its institutional and regulatory environment.

Conversely,

Brazil's success in achieving its mitigation and sustainability goals is due to the CDM's assistance in institutional capacity building in Brazil.

Participation in the CDM is not only influenced by a host country's interest and desire to be a part of the mechanism but also by the institutional bulwarking it can provide for its operation. This explains the unfortunate asymmetries in CDM statistics between emerging economies and less developed countries (LDCs). Brazil has served as a popular destination for climate finance and CDM investment because of the combination of CDM opportunities afforded by it, its political engagement with the climate community, its institutional capacity and its quick response to building the regulatory mechanisms required for the carbon market. Brazil's national climate programmes have often been bolstered and legitimated by regional climate laws—a scenario that has gained momentum because of its state-oriented federal structure. Brazil has skilfully interpreted the Kyoto Protocol's vast arsenal of rules and regulations to fit within its national context, thus strengthening the CDM's role in the country. An important exception to this hypothesis is the relatively weak institutional and regulatory support offered by Brazil to the emissions trading modality. Carbon markets in Brazil are still in their infancy and though private Brazilian markets do exist, with a recent move being made to create regional markets in Rio de Janeiro and Sao Paulo, an overarching national carbon market regulatory authority does not exist as of now. This could be an important reason behind the less-than-overwhelming activity in the CDM sourced emissions trading market in Brazil.

The converse hypothesis illustrates the complementary role of the CDM in institutional capacity building in Brazil by demonstrating how the framework of the CDM has been employed by regional and national policies to strengthen their own adaptation and mitigation efforts. The examples of Sao Paulo and Amazonas demonstrate how the creative use of CDM has inspired state policies and served as an additional tool for implementing public policy goals. Additionally, the CDM has compelled methodological and implementational rigour in climate monitoring activities. The strict guidelines of verification and validation have created a system of business-like efficiency and ownership in the otherwise lax bureaucracy in Brazil. New standards of professionalization and accountability have been introduced in climate monitoring programmes in Brazil that has lent credence to Brazil's implementation of mitigation programmes.

Thus, both these hypotheses have been proven.

2) The second hypothesis is:

CDM has fostered investment in previously under-represented energy sectors by encouraging financial and technological transfers.

The contribution of CDM to technological transfers has itself been regarded with a considerable degree of scepticism by some scholars. Therefore, it would seem a fallacious proposition to frame a hypothesis that not only depends on there being a significant number of technological transfers, but, also requires that those transfers played a potent force in encouraging not just conventional CDM projects but *under-represented* projects. However, an in-depth analysis of twelve CDM projects demonstrated that technological transfers do indeed take place more often than expected. These transfers are more likely to occur for unconventional and unique project design types; and in nascent sectors. For instance, there is a greater likelihood of technological transfers in the wind energy sectors and landfill gas projects as well as large or unusually situated hydroelectric power plants. While a link between cause and effect has not been established adequately in the case of technology transfers, the study does indicate that unique energy projects do tend to attract technological transfers without which their implementation would be in jeopardy. Before the CDM, investments in wind energy were scarce due to the novelty of the technology in Brazil and the relative neglect it had faced from the government. European countries entered the wind energy CDM sector, bringing with them financial transfers as well as technical expertise which had been fine-tuned over a period of decades. Landfill gas generation has primarily employed an interesting mix of international technology flavoured with locally adaptive technology. It is fair to say, that the carbon market's incentives for landfill management has proven to be a bit of a golden carrot for municipal bodies. State promoted landfill gas projects have recently come into vogue in Brazil and this would in all probability have taken many more years to come about if it were not for the dissemination of technological inputs through CDM projects.

Finally, the most persuasive example of the CDM's financial and technological incentives in promoting renewable energy is, ironically enough, in the hydroelectricity sector. Though the CDM in this sector has its share of vocal critics, the success of small-scale CDM projects and the introduction of programmatic CDM have renewed interest in a sector that was thought to be saturated and exploited to capacity. Employing international capital and know-how in these sectors has re-invigorated a sector that had started to dull the interest of home-grown investors.

Thus, the findings do resonate with the hypothesis though there are complications in determining the cause-effect relationship with absolute certainty. A more conclusive relational arc can be drawn out in future, when these sectors gain maturity.

3) The third hypothesis addresses the issue of participation amongst the traditionally marginalized stakeholders of natural resources as well as the crux of Brazil's emissions profile—deforestation:

Brazil's participation in the carbon market has included the participation of primary stakeholders and has thus, increased forestry conservation activities.

Emissions-trading in the forestry sector was widely criticized for potentially encouraging unsustainable forest management and marginalizing the caretaker communities of forest resources. In fact, critics of the carbon market have often rued the financial incentives tied into the mitigation process in general, for fear that it could promote projects with high financial returns-on-investment at the cost of more beneficial but less profitable ventures (end-of-pipe versus renewable energy). While the profit motive has been the prime driver in non-forest sectors, in non-CDM forestry projects emissions trading has been shown to reduce deforestation, empower local communities and provide local governments with finance. Therefore, as predicted by Dudek and Leblanc (1992) two decades ago, emissions trading has been shown to promote the preservation of Brazil's tropical forests by monetizing their preservation—an objective that has been found to be best achieved when local communities are allowed to play a pivotal role in forestry management.

Therefore, even though the primary source of this particular kind of carbon finance isn't CDM projects, this is proof enough that future iterations of emissions trading modalities can safely include avoided deforestation activities to achieve sustainable mitigation.

On the basis of this study, the following recommendations are being put forward to strengthen the CDM and emissions trading modalities of the flexible mechanisms:

- *Simplification of the CDM and Emissions Trading Process:* In spite of the addition of new categories of CDM such as small scale and programmatic CDM projects, many niche projects which would be ideal for remote regions in under-represented sectors, such as energy efficiency, are still excluded from the CDM process. The lengthy, almost bureaucratic verification and validation steps are major disincentives for small players, who are more in touch with grassroots realities. The emissions trading process through the CDM is expensive and fraught with delays. Since the emissions trading process is the monetizing and financial returns stage of the CDM project, small and medium sized CDM projects often get stalled because of diminished liquidity and late returns-on-investments.

- *Revised Framework and Guidelines Specifying that CDM Benefits Should be Shared Between Local Communities and Project Developers:* This can be achieved partially through a regular system of consultations with local communities. The designation of a community focal point and project developer focal point could smoothen the channels of communication between the two. This could also facilitate a real-time feedback mechanism between the two, actually allowing greater benefits for both parties.

- *Post-PDD Documentation of Sustainability Benefits*: A problem in determining the sustainable development benefits of the twelve formally analyzed projects in chapter 3 was the lack of detailed and credible third-party documentation. The PDDs served as the primary source of information which is problematic because it depends on self-reporting and projected estimates. Brazil's DNA doesn't maintain independently assessed reports for cataloguing sustainable development benefits either and validation reports for PDDs seldom include details on sustainability. Self-reporting is never an ideal means of information-gathering when subjective gains for an *external* party are to be ascertained. Therefore, it is recommended that, at least for large scale projects, an exhaustive method for quantifying certain sustainable benefits be developed, along with the modalities that can impartially assess the delivery of those benefits.

- *Reducing Registration and Validation Expenses:* The entire seven-step CDM process is very expensive because it requires detailed assessments of all project areas, area and resource mapping, stakeholder consultations, external registration and validation firms and the costs of contacting potential buyers. While internationally financed or corporate backed projects don't find these financial obligations cumbersome, small and medium projects can get crippled by the process. A UNFCCC appointed validation firm for small or NGO-led projects could solve part of this problem. The UNFCCC has recently announced the establishment of a need-based fund to give interest free loans or grants to CDM projects but this is only limited to the least developed countries as of now.

- *The Incorporation of the REDD+ projects within the CDM framework*: Brazil's success with the REDD+ framework shows how rain forest preservation activities can empower communities and bring in financial returns for the state as well.

- *A bifurcation of CDMs project activity categories for emerging and less developed countries:* There has been a lot of dissent over the inclusion of certain activities (this includes an expanded scope for forestry activities and emissions removal activities). The major bone of contention is over projects that are perceived to have negligible additionalities and mitigation potential and, therefore, end up serving as profit generation endeavours. These projects could be potentially valuable GHG mitigation tools for smaller countries and should be allowed for them specifically. An exception to this suggestion would be where a country has massive potential in a certain sector, such as Brazil's potential for avoided deforestation projects, so that it can focus on the most viable project activities given its emissions profile.

- *Creating a Unified Emissions Trading/Carbon Market:* As mentioned in the fourth chapter, the Gold Standard has lent serious credibility to the carbon market, with even the UN making the decision to buy Gold Standard certified carbon credits to offset its carbon footprint. If the CDM credits and Gold Standard credits were to be consolidated under one common market, with the CDM credit certification being subject to the same levels of scrutiny as the Gold Standard VERs, there would be less regulatory confusion. Buyers and sellers too, would be able to make transactions under one roof, with transparency regarding the prices of carbon credits. Another advantage of this system would be to break the complete reliance on the European Union's Emission Trading System which has had potentially distortionary effects on the carbon market because of the prolonged financial recession.

The earth's flailing health can be rehabilitated and a restorative equilibrium can be achieved if there is concerted action between international and regional governance on one hand and local communities on the other. CDM and Emissions Trading represent two effective multilateral tools to achieve this collaborative action. These mechanisms accommodate national needs and instead of dictating a condescending set of policy prescriptions that member countries must follow, there has been a genuine attempt made to allow different states to follow nationally appropriate mitigative actions. Therefore, there is a future for these mechanisms beyond 2012, provided timely reforms are undertaken.

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