The Clean Development Mechanism's effect on carbon market development in the sugar sectors of India and Brazil

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1. Introduction

Over the past two decades, climate change has evolved from a topic of interest primarily to a relatively small set of stakeholders to a topic of broad international policy concern. Moreover, in recent years, a crystallizing scientific consensus, shifting perspectives on energy politics, improvements in technology, and expanded comprehension of the potential impacts of climate change have bolstered support for substantial and broad-reaching policy interventions—particularly at global and national levels—to address the causes and consequences of a changing climate. While such a massive and long-term societal project must necessarily draw on multiple policy strategies (Prins and Rayner 2007), and will likely entail substantial cross-national variation, there are at least two salient points of substantial agreement: First, to reduce the risk of dangerous climate change, the absolute global level of emissions must fall dramatically in the next 50 years, implying major cuts not only in highly developed economies but also in the largest developing economies such as China, Brazil, India, South Africa, and Indonesia; and second, that one of the macro-economically preferable approaches to reducing the negative externalities of greenhouse gas emissions is to impose a cost on those emissions, allowing firms to incorporate an approximation of the social cost of emissions into their investment decisions.

While this externality pricing in theory can be accomplished either through a tax or an emissions trading system, he preferred vehicle in the climate case will likely to be the expansion or modification of existing greenhouse gas emissions trading markets. The Kyoto Protocol (1997) established a system for international allowance trading among developed countries and established the project-based Clean Development Mechanism to enable low-carbon projects in developing countries as well. The EU subsequently established their economy-wide Emissions Trading System (ETS) that remains the world's largest and most liquid allowance trading system. The past decade of experience with emissions trading has built substantial institutional capacity and simultaneously created a substantial constituency in support of trading over tax. Thus, while it is possible that policy attention may eventually swing toward a tax, it seems very likely that in the near term, emissions trading systems will expand substantially to cover more sectors, countries, and gases.

As such, the world's largest and most rapidly developing economies are likely to experience increasing carbon prices via penetration of domestic and international greenhouse gas (or carbon[5]) markets. The argument for this expansion is based on the reasonable economic premise that establishing a low or moderate price for carbon will leverage investment in lower-carbon technologies, thereby accelerating the transition to a low-carbon economy in developing countries. Yet this reasonable premise remains largely unstudied in the developing economies; in

[5] Carbon dioxide (CO_2) is one of a number of greenhouse gases that contribute to climate change. Some emissions trading policies cover only CO_2 (such as the EU-ETS); others cover CO_2 and other greenhouse gases. Policies are usually denoted in terms of CO_2 or CO_2-e (meaning CO_2-equivalent), and therefore emissions trading systems to control greenhouse gases are often referred to as "carbon markets."

reality, there has been little systematic investigation of the success of carbon markets in different country or sectoral contexts.

We have sought to address this gap by investigating firm responses to carbon markets in two major developing economies. Based on extensive interviews with firm managers, government representatives, and other experts, we discuss differences in carbon market development in the sugar sector in Brazil and India. Unlike many macro-policy studies of CDM and development, we focus on the firms' perspectives on the regulatory and financial dimensions of low-carbon investment. While both Brazil and India have active and expanding sugar industries, the evolution of carbon markets varied greatly across the two countries, and depended not only on the international policy design but also on domestic implementing regulations, differences in consultancies, and modes for information sharing and capacity building in each country.

2. Differential participation in the CDM

Many developed countries have, over the past five years, implemented economy-wide cap-and-trade systems. Such systems, also called "allowance systems," set an absolute cap on emissions for certain sectors of an economy, and then allow trading among firms to achieve the cap. The EU ETS and the international allowance trading system of the Kyoto Protocol are the best-known allowance trading systems, but similar systems are also operational in Australia (New South Wales) and the Northeast U.S. (the Regional Greenhouse Gas Initiative). Programs are being developed for Japan, the Western U.S. and the U.S. Federal level. In contrast, the Clean Development Mechanism (CDM) is the only existing regulatory mechanism[6] for pricing carbon and other greenhouse gases in developing countries (Streck 2004). Unlike allowance (cap-and-trade) systems, the CDM is a project-based system: instead of an economy-wide cap, credits are generated by individual projects that must be approved by a central regulator (the CDM Executive Board) and then subjected to regular auditing and verification procedures. Upon completion of this complex legal application, the project is awarded credits (Certified Emissions Reductions, CERs) that can be sold on international markets. Although Kyoto Protocol spurs some demand, most of the buyers of CERs use them for compliance with the more legally binding EU ETS, which has a provision allowing the use of certain CERs.

As a result, the CDM has expanded rapidly despite its bureaucratic complexity. To date, the CDM has spurred over 4700 projects in over 70 countries. In 2007, CDM projects accounted for 551 million tonnes of CO_2-equivalent reductions, which is approximately 15% of the global total for all carbon markets (the EU ETS represents the largest single market, with over 75%. The 2007 CDM market volume was valued at approximately $7.5 billion, out of a total carbon market volume of $50 billion (Capoor and Ambrosi 2008). The projects currently registered, awaiting validation, and requesting registration are expected to generate over 2.9 billion tons of CO_2 equivalent reductions in the period 2008-2012. (J. Fennhann, CDM Pipeline 01 May 2009).

[6] A parallel market has arisen for the largely unregulated market for so-called "voluntary" emissions reductions (Bumpus & Liverman 2007, Ecosystem Marketplace 2009). Projects that generate voluntary credits may be subject to outside validation and independent industry standards (e.g. the Voluntary Carbon Standard).

Although the Kyoto Protocol expires in 2012, the CDM is expected to continue operations beyond that date, and existing projects are expected to realize a further 3.4 billion tons of CO2e reductions in the period 2013-2020.

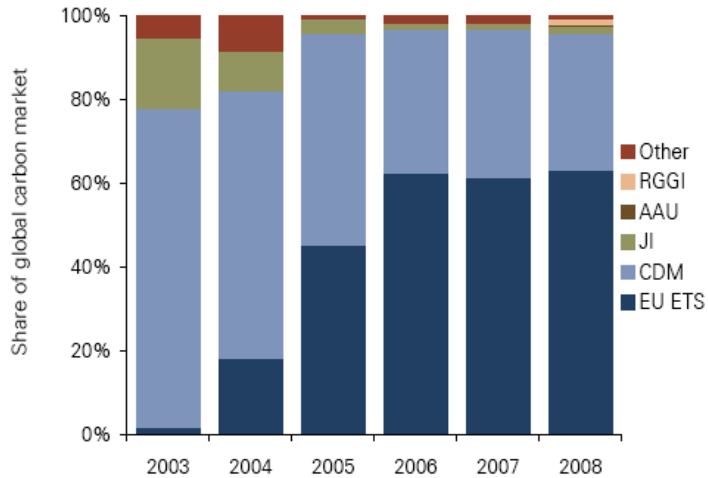


Figure 1. Relative share of emissions trading policy platforms over time. The EU ETS currently accounts for a majority of transactions in the regulated market, but CDM has a substantial presence overall and is the predominant project-based system. AAU=Assigned Amount Units under the Kyoto Protocol; JI = Joint Implementation under the Kyoto Protocol; others defined in text. (source: Carbon 2009, PointCarbon LLC, presented at conference *Carbon Market Insights 2009.* Available at www.pointcarbon.com, Accessed May 26, 2009).

The CDM has some well-understood shortcomings, including its need for extensive technical and political institutions to make difficult judgments on the viability of widely disparate project proposals (Begg and Horst 2004; Bernow et al. 2001; Bode and Michaelowa 2003), and the unwieldy legal process (Jotzo and Michaelowa 2002; Krey 2005; Michaelowa and Jotzo 2005; Zhao and Michaelowa 2006). In addition, it has elicited extensive normative discussion on, for example, how to implement the Kyoto Protocol's mandate for sustainable development (Ellis et al. 2007; Hultman et al. 2009), and about the rectitude of privatizing emissions rights (Bachram 2004; Bumpus and Liverman 2008; Lohmann 2006; Pearson 2007). Nevertheless, many observers expect a modified, and possibly expanded, form of CDM to continue in the next stage of international negotiations. Implementing this expansion effectively requires understanding how the CDM influences the actors involved–namely, the individual firms who undertake capital allocation decisions (Pulver et al, submitted; Schneider et al 2009).

Although over 70 countries are currently participating in CDM, a very small number of countries account for the vast majority of emissions reductions to date. As of May 2009, the top eight countries—China, India, South Korea, Brazil, Mexico, Vietnam, Chile, and Egypt—account for 96% of issued CERs. More strikingly, the top four account for fully 91% of issued CERs. It should be noted that this high proportion will almost certainly decrease in future years. Because issued CERs are cumulative over time, that statistic as of May 2009 reflects the much smaller set of participating countries in the early years of the CDM, when Brazil, India, and China were particularly active. It also reflects the early predominance of so-called "industrial gas" projects (such as HFC and N_2O decomposition); these projects produced large quantities of inexpensive CERs but were limited to large chemical industry plants, which tended to be located in a few middle-income industrializing economies. Given that the very recent projects are distributed relatively more evenly across countries and sectors, one would expect that the fractions of issued CERs will slowly move away from this highly skewed distribution. Nevertheless, the relative size of the potential reductions in the major economies of China, India, and Brazil will likely ensure them a relatively large share of the market in perpetuity.

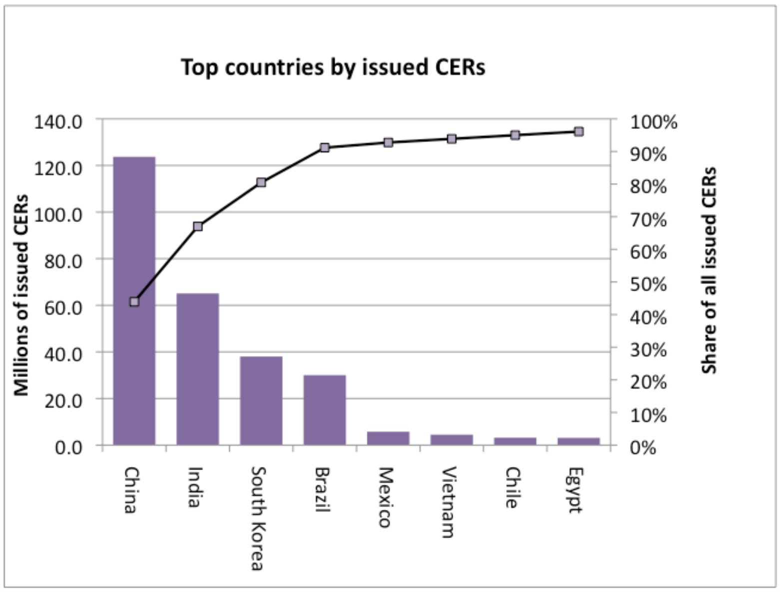
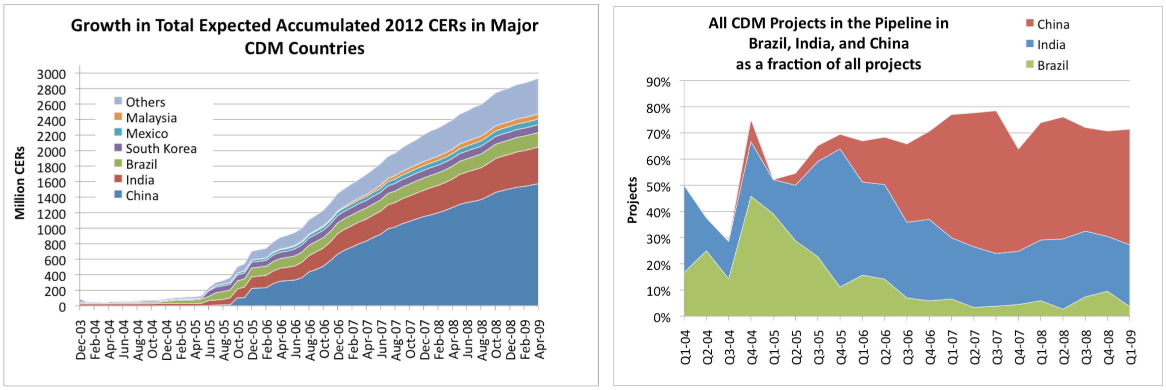


Figure 2. Top eight CDM countries by historical CER issuance. Although over 70 countries are participating in the CDM, the top eight countries account for 96% of issued CERs, and the top four account for 91%. India and Brazil account for roughly 23% and 11% of issued CERs, respectively. Note that issued CERs are "to date" and do not scale linearly to expected CERs to 2012 or 2020. (source: CDM Pipeline, May 1, 2009).

The pipeline of projects in the CDM has evolved over time and has not arisen uniformly across countries or sectors. After the Kyoto Protocol entered into force in early 2005, activity increased rapidly (Figure 3a). However, although China is now the largest contributor of CDM projects and expected CERs, the earliest days of the market were dominated by Brazil and, subsequently, India (Figure 3b). In the stage of initial growth, Brazil was the early leader with 46% of total projects in the pipeline in late 2004. India soon overtook Brazil, claiming 53% of projects in late 2005, and remained the leader until 2007. India and Brazil currently account for roughly 23% and 11% of issued CERs, respectively (Figure 2) and have submitted applications to host 1358 and 439 and CDM projects, respectively (out of approximately 4700 total).



(a) (b)

Figure 3. (a) Growth in the total expected accumulated 2012 CERs by country, 2003-2009. (b) Growth of the number of projects in the CDM project pipeline in the major participating countries, 2004-2009. Brazil and India were early leaders in project numbers and volumes (not shown); Brazil claimed 46% of projects in the pipeline in late 2004, and India claimed 53% of projects in late 2005. (source: CDM Pipeline, May 1, 2009).

3. Case: CDM and cogeneration in the sugar sector

The CDM has thus witnessed rapid growth in activity since 2005, and Brazil and India were pioneers in adopting this new and untested policy mechanism. The question therefore arises as to why these two countries exhibited early and successful activity. A few reasons are clear: compared to other developing countries, they exhibit a superior institutional CDM capacity, healthy investment climate, and high GHG mitigation potential. Yet despite these indications, questions remain as to what aspects of the two countries were particularly favorable to carbon market development, and simultaneously whether the market response might have been even greater under different policy scenarios.

In this paper, we examine the factors behind the differing evolution of CDM in Brazil and India. We focus on one particular technology in one sector that has similar characteristics across both countries—sugar. Holding the sectoral and technological context constant largely eliminates the possibility of seeing differences that arose due to the technical characteristics of the two countries' economies. Based on extensive interviews with managers in the sugar industry as well as interviews with government agents, consultants, auditors, and other experts, we examine four dimensions of difference across the two countries:

(1) the domestic policy and regulatory regime;
(2) the involvement of private sector intermediaries;
(3) the implications of CDM regulatory decisions;
(4) the activity of non-governmental actors and capacity-building activities

Research approach

Our research approach investigates firm, sector and national-level dynamics. Research findings are based on a combination of interview and archival research. We have, as of May 2009, interviewed managers at approximately 65 firms in the sugar industry across both countries (n= 25 sugar firms, representing 34 mills for India, n=40 in Brazil), as well as 38 government representatives, consultants, auditors, industry representatives and other key actors. At the firm level, interviews were conducted with sugar mill owners/managers of both CDM and non-CDM mills from June 2008–May 2009. Interviews were conducted both in person and via telephone. Interview questions focused on firm-level CDM decision processes, perceptions of benefits and risk, and firm operation characteristics. Mill-level interview data was supplemented by descriptive statistics of the uptake of CDM in the sampling universe of Brazilian and Indian sugar mills.

Sector and national dynamics were elucidated via in-person interviews with Brazilian and Indian carbon market experts (n=38), conducted in Brazil in June 2008 and in India from January-May 2009. Experts interviewed included industry trade association representatives, carbon market consultants, CDM project developers, CDM project verifiers (auditors), academic experts, state and national government agency representatives, representatives from international organizations engaged in the carbon market, and local/national environmental advocacy NGOs. For the Brazil case, archival sources included carbon market reports issued by the Brazilian ministries of science and technology and agriculture, the São Paulo Sugar Industry Association (UNICA), the Center for Biomass Energy at the University of São Paulo (CEMBIO), and the São Paulo Cogeneration Association (Cogen-SP). India archival sources include CDM project lists compiled the Ministry of Environment, sector data compiled by the Indian Sugar Mills Association (ISMA) and the Sugar Technologists' Association of India (STAI), and various carbon market analyses produced by NGOs and international organizations. Finally, data on CDM project intermediaries, dates, Executive Board status, and project locations were taken from individual Project Design Documents (PDDs), which are part of the regulatory record, and the Danish Risø Laboratory's CDM Pipeline database.

CDM project characteristics

Nearly all the CDM projects in sugar mills award carbon credits for upgrading bagasse cogeneration facilities. These projects are essentially energy efficiency projects, and involve changing a low-efficiency boiler for a high-efficiency boiler to generate more electricity from the same amount of fuel. The boilers are fueled by bagasse, a sawdust-like waste product resulting from the sugarcane milling process, and the electricity is therefore derived from renewable biomass. The carbon credits issued to successful projects are based on the extra electricity generated by the more efficient boiler: the logic behind such credits is that the additional biomass electricity is "clean" from a greenhouse gas perspective, and displaces "dirty" energy that might be generated using coal. Within the universe of CDM projects, bagasse projects accounted for approximately 6.1% of expected reductions to 2012 in India and 5.2% of expected reductions to 2012 in Brazil (Figure 4). As of early 2009, the fraction of mills undertaking this type of project was approximately the same for both countries: 77 out of 559 (15%) in India compared to 60 out of 417 (14%) in Brazil.

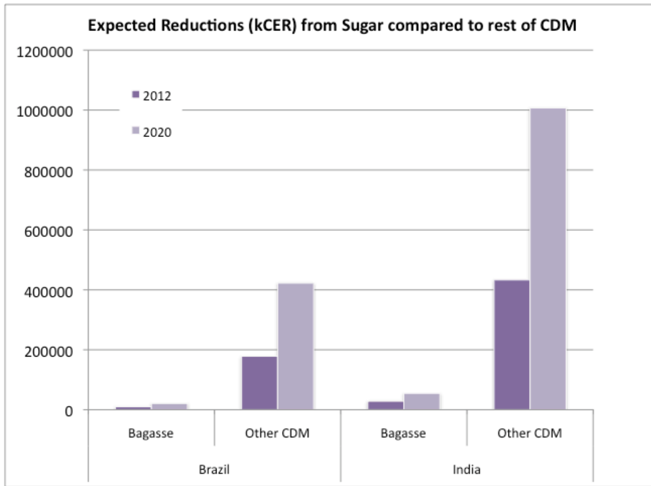


Figure 4. Comparison of expected reductions from sugar bagasse projects to reductions from the rest of the CDM. (source: CDM Pipeline, March 1, 2009).

There is one important difference between projects in the two countries, however, and that relates not to the technology itself but to the context in which the projects operate. This difference arises from the overall mix of electricity generation in the electricity grid: Brazil overall derives over 80% of its electricity from on very clean hydroelectric generation, and only marginally from high-carbon coal. India, on the other hand, relies heavily on coal. The amount of electricity emitted, on average, by the surrounding grid is called the "grid emissions factor" As such, if national average emissions are used to determine the grid emissions factor, the electricity displaced from a Brazilian bagasse cogeneration project, being only 20% "dirty", will earn far fewer emission reduction credits than the same quantity of electricity from an identical installation in India.

Sugar industry in Brazil and India

Brazil is the largest sugarcane producer in the world. In 2007, the country produced 517 million metric tons of sugarcane, 33% of the total world production (FAO, 2007). It has approximately 400 sugar mills spread over two primary growing regions (Figure 5): the North-Northeast near the Amazon (e.g., Maranhao, Bahia, and Piaui states) and the Central South region inland from Sao Paulo city (e.g. Sao Paulo, Minas Gerais, and Parana states). Most of the activity occurs in the Central South, which claims 88% of cultivated land and approximately 98.9% of sugarcane production (Ministry of Agriculture, Livestock, and Supply 2009). Nearly 60% of Brazilian sugar cane is produced in the state of São Paulo alone (Macedo 2008:5; Roman 2007). Brazil's sugarcane is used to produce both refined sugar and ethanol fuel for vehicles. In response to energy security concerns in the 1970s, Brazil initiated a system of financial incentives to promote independence by shifting to an ethanol vehicle fleet. Although the production goals fell short during the era of low oil prices, the infrastructure had been established. The market expanded after 2003 when flex-fuel vehicles (able to run on either ethanol or gasoline) began to enter the market. A second major policy intervention in the late 1990s was the deregulation of the electricity sector (Roman 2007). Sugar mills had long produced on-site steam for their milling process, and often tapped this steam for internal electricity generation and heating, but could not sell excess electricity to the grid (ANEEL 2006). After deregulation the mills had the option to earn addition income from electricity sales. Because the electricity is renewable, it was further supported when Brazil enacted renewables incentives under the PROINFA (Programa de Incentivo a Fontes Alternativas de Energia Elétrica, Law 10438) program in 2002.

India is the second largest producer of sugarcane in the world. In 2007, it produced 356 million metric tons of sugarcane, accounting for 23% of the total world sugarcane production (FAO, 2007). Sugarcane is produced mainly in India's nine states: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu and Uttar Pradesh (Figure 6). The northern state of Uttar Pradesh alone accounts for approximately 50 percent of the total sugarcane production in the country (MoA, 2003). India has approximately 580 existing sugar mills, out of which about 450 operated during the 2005-06 season (ISMA, 2006). Approximately 55 percent of the existing mills are owned and run by farmers through cooperatives, while the rest are public and joint sector companies (ISMA, 2006). Sugar is the main product of the sugar industry, while ethanol is produced mainly from molasses. In 2006, the Indian government approved the blending of five percent of ethanol in fuel.

In India, interest in high efficiency bagasse cogeneration started in the 1980s when the supply of electricity start falling short of demand. The Ministry of Non-conventional Energy Sources (MNES), now renamed as the Ministry of New and Renewable Energy (MNRE), launched the national program on Promotion of Biomass Power/ Bagasse Based Cogeneration in 1992 (Haya 2009). This ministry, which oversees the policy for renewable energy in India, started providing capital and interest subsidies for bagasse cogeneration projects, especially for boiler pressures higher than 60 bar (Purohit, 2007). Other incentives for cogeneration projects included sales tax and excise duty exemption, accelerated depreciation of cogeneration equipment, customs duty concession, tax holidays on income from power projects, exemption from local sales tax in some states and preferential tariffs (Purohit, 2007). Organizations like the United States Agency for International Development (USAID), which helped setup demonstration projects and the Asian Development Bank (ADB), which offered loans through the Indian Renewable Energy Development Agency (IREDA) played a significant role in kick starting cogeneration projects in India (Haya 2009). The Electricity Act 2003 has introduced reforms in the electricity sector and has further provided impetus to cogeneration in the Indian sugar industry.

Figure 5. CDM (☐) and non-CDM (○) sugar mills in Sao Paulo State, Brazil.

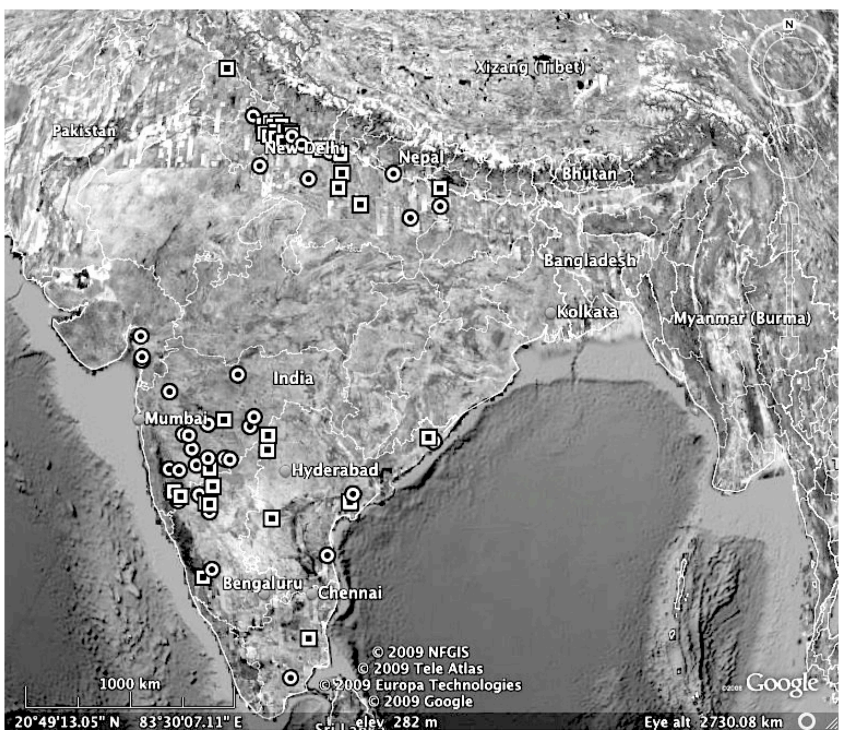


Figure 6. CDM (☐) and non-CDM (○) sugar mills in India.

4. Comparing market evolution in India & Brazil

Domestic regulatory regime

The Kyoto Protocol states that the CDM has a dual purpose of simultaneously promoting emissions reductions and sustainable development in developing countries. However, the host country governments retain the right to approve or veto individual projects, and are required to name a "Designated National Authority" (DNA) to approve projects before they can be submitted to the CDM Executive Board. Because the particular methods of operationalizing these requirements rests with diverse governments, the details of the domestic regulatory regime also vary broadly. Brazil and India chose substantially different paths in interpreting both requirements. Brazil's government was an early proponent of CDM in the international negotiations and has retained a strong interest in the success of the CDM (Brazil 2004; Michaelowa 2003). Indeed the CDM itself can be traced back to a proposal for a Green Development Fund submitted by the Brazilian delegation to UN climate negotiations in May of 1997 (Oberthuer and Ott 1999).

In part because of this longstanding state interest, the governmental CDM project office has taken a very active role in screening CDM projects hosted in Brazil. Whereas most countries have opted to screen only on the sustainability requirement, leaving the technical decisions about emissions reductions to the CDM Executive Board, the Brazilian DNA created an office to vet the technical qualities of the projects before they are forwarded to the Executive Board. The resulting stringency, which is highly unusual (and possibly unique) relative to other host countries, has led to a number of rejections at the national level, creating an additional regulatory hurdle to proposing a CDM project in Brazil (Pulver et al submitted). However, participants report that, especially in the early years, projects approved by the Brazilian DNA were likely to be approved at the international level. Our interviews indicate that this outcome was intentional, and that the Brazilian DNA consciously sought through its methods to increase the quality of the overall CDM and also to acquire a reputation for technical reliability within the international community. In contrast to Brazil, India was an initially hesitant participant in CDM activities and plays a relatively detached role in CDM project approval (Chandler et al. 2002; Chowdhury and Kumar 2005; Dadhich 1997; Krey 2005; Parikh and Parikh 2004; Shukla, Sharma and Venkata 2002; TERI 2005).

In contrast to the rigorous review undertaken in the Brazilian DNA, the Indian DNA decided to take a less regulatory approach. First, like most other DNAs (including Brazil's), India's DNA interpreted "sustainable development" broadly. Second, and in contrast to Brazil, India's DNA interpreted its vetting procedures for the potential emissions reductions much more narrowly: instead of conducting extensive analyses to reach its own conclusions about project additionality, the Indian DNA confined its investigation to assess whether the project was well-conceived and likely to result in some emissions reductions. It viewed its role only as approval, and not as the regulator, under the logic that the independent validator retains responsibility for assessing the emissions reductions of the project, and the CDM Executive Board, at the international level, retained full responsibility for making the regulatory judgment on the technical merits of the project. In doing so, the India DNA deliberately did not seek to create an internal technical assessment process. The relatively laissez-faire approach of the Indian DNA was viewed by participants as being more supportive of market development. In addition, while it is entirely conceivable that the stringency of the Brazilian DNA did dampen the development of domestic carbon expertise, it interestingly did not seem to lead to greater reliance on multinational consultancies. Rather, the opposite seems to have happened, at least in the sugar sector. It may be that local expertise was simply better tailored to navigate the more complex domestic regulatory body.

International regulatory regime

Once the DNA of a country issues an approval letter and the project is validated by a private sector Designated Operational Entity (DOE), the project can be submitted for approval to the CDM Executive Board. The EB is the international authority based in Bonn that establishes the rules governing the CDM, registers CDM projects, and issues CDM credits. Once a project is registered, project proponents must have the resulting emission reductions verified and then certified by the CDM Executive Board. Only then can they sell any resulting emission credits into the market as Certified Emission Reductions (CERs). Importantly, no project can be approved unless there is a pre-existing approved "Methodology" which describes that specific technological context, a corresponding logic of emissions reduction within the context, and a quantitative method to monitor and evaluate individual projects. Methodologies do not exist unless a party submits a proposal to division of the EB called the Methodology Panel; the Methodology Panel convenes technical experts to evaluate and rule on proposed methodologies. As such, project proponents, especially in early years would often need first to submit a methodology and guide it to approval before they could hope to register their project.

Once a methodology is approved, the project can be submitted. Under the approved methodology, candidate projects are evaluated according to two central criteria. First, they must be shown to create emissions reductions beyond a baseline of "business-as-usual." This requirement, drawn from the basic tenet of project-based emissions trading (Fischer 2005), demands a judgment as to what the state of the art is in a given sector, industry, or technology. If, for example, it can be demonstrated that the usual practice is to replace 21-bar boilers with 80-bar boilers, then a project cannot get credits for installing 80-bar boilers. A related requirement is that projects must be shown to be profitable only with CER (carbon) revenue, or that there are substantial barriers to the adoption of the new technology that CER revenue is necessary to overcome them. If, for example, installing a more efficient boiler can be shown to be profitable owing only to electricity sales, and independent of CER revenue, then the project is not "financially additional" and must be rejected.

These requirements played a major role in the development of sugar cogeneration projects in Brazil and India, as did one the difference in grid emissions factor described above. In the period 2005-2006, the approved methodology AM00015 focused on the barriers that boiler upgrades faced, rather than strict financial additionality, and was therefore favorable to the proposed projects in Brazil, where electricity sales could be substantial and the unfavorable grid emissions factor suppressed the carbon revenue. When AM0015 was replaced by a more general methodology, the case for barriers was removed, and strict financial additionality required, greatly increasing the difficulty of approving projects in Brazil. As such, Brazilian activity dropped off substantially while Indian activity continued to expand.

Intermediaries

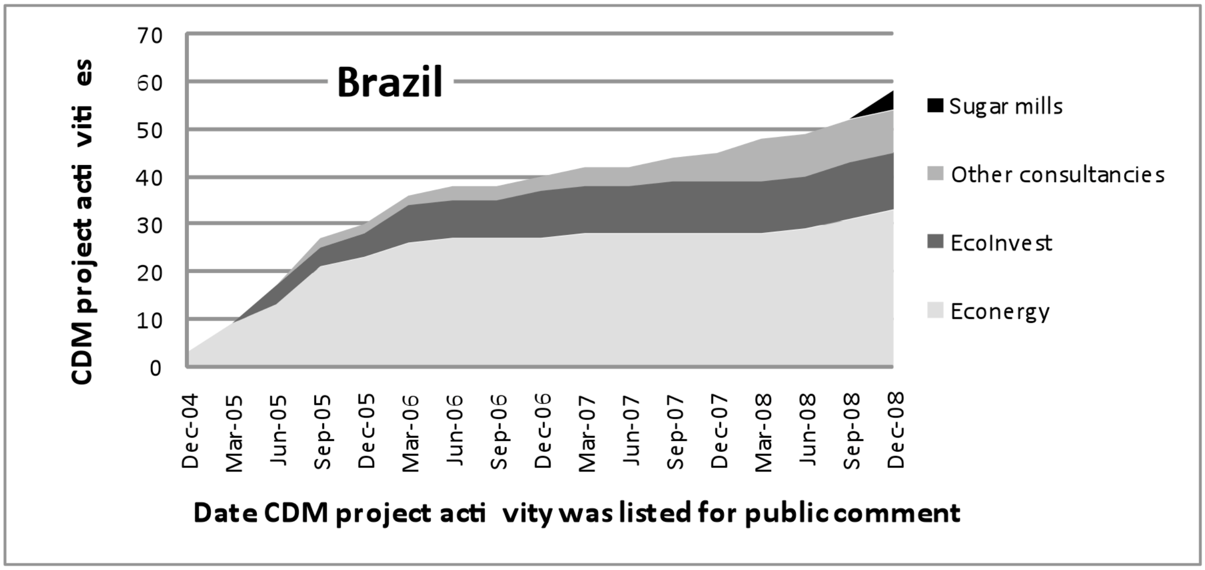
The institutional complexity of the UN CDM certification process—which creates both informational and procedural barriers—creates a business opportunity for intermediaries. Diverse consultancies have filled this need, offering expertise to shepherd potential CDM projects from conception to issuance of credits. Such intermediaries have been central to the success of the CDM in the sugar sectors in both Brazil and India. The two markets differ in the timing of their growth and in the type of intermediary organization active in the market (Figure 7). However, in both countries, CDM project development in the sugar sector is dominated by a few key intermediaries whose early success was based on a combination of pre-existing relationships with their sugar mill clients, specialized knowledge of the CDM methodologies applicable to the sugar industry, and early success with demonstration projects. These few dominant firms currently coexist with a multitude of small "boutique" consultants (Figure 8), though it remains to be seen whether this structure will be sustained in the longer term or whether the industry will undergo substantial consolidation.

Activities in Brazil launched sugar sector CDM projects globally, and the Brazilian market was ahead of the Indian market for the first few years that the CDM was in operation. In particular, the efforts of two Brazilian consulting companies, EcoInvest and Econergy Brazil helped launch CDM in the sugar sector: in our initial study of Brazil's sugar industry (Pulver et al submitted), consultants were named as the most important information sources by six of eight mills, and the second most important source by the other two. (The major Brazilian sugar industry association, other sugar mills, family/friends, and media formed the second tier of information sources.). EcoInvest developed a bagasse-based power project at a Brazilian sugar mill that was awarded emissions reductions credits under the Dutch CERUPT program. Meanwhile, Econergy Brazil sought approval for a project methodology for bagasse-based power generation at sugar mills from the newly constituted CDM Executive Board. Econergy's methodology (AM0015, described above) was approved and became the vehicle through which the first 30 sugar sector projects in Brazil were submitted for registration to the CDM Executive Board, in the period from September 2004 to November 2005. During that same period, only two Indian sugar mill projects were submitted under AM0015 and another six small scale projects under methodologies AMS-I.C. and AMS-I.D. CDM project activities in Indian sugar mills did not expand until 2005, when AM0015 was superseded by a consolidated methodology (ACM0006), applicable to electricity generation from a range of biomass sources. ACM0006 incorporated elements of AM0015, as well as elements of three other methodologies, including one drafted by the UK consulting firm, Agrinergy Limited, the key intermediary in the sugar sector in India. The Indian sugar sector CDM market saw significant growth in 2006 and 2007, surpassing the Brazilian market, which stagnated during that same period.

In addition to differences in the timing of market growth, the Brazilian and Indian markets differ in the kind of intermediary organizations that have come to dominate the sector. EcoInvest and Econergy Brazil, the two consultancies that have developed over 75% of sugar sector CDM projects in Brazil were both founded by Brazilians, with an initial national focus, and operated as niche organizations, created to profit from the carbon market. In contrast, the Indian sugar CDM market has been driven by the activities of international consulting groups, namely Agrinergy Ltd, registered in the United Kingdom, and Ernst & Young (E&Y). The former is also a niche consultancy, specializing in carbon trading. The latter is one of the four large global professional services and auditing firms. Agrinergy and E&Y account for 36% and 15% of Indian sugar sector CDM projects, respectively. The third major share of the Indian market (30%) are projects developed by sugar mills themselves. These mills may seek the counsel of consultants but choose to develop internal capacity to prepare a project design document and shepherd a CDM project through the bureaucratic process. Very few mills in Brazil have opted to pursue this route. The field of intermediary organizations on both countries is rounded out by a collection of smaller consulting group and some nongovernmental organizations that on average have developed one or two bagasse-based CDM projects.

Differences in the timing of market growth and characteristics of market players mask underlying similarities in the strategies which enabled Econergy Brasil, EcoInvest, Agrinergy and E&Y to dominate CDM activities in the Brazilian and Indian sugar sectors. One key element of each consultancy's success was to build on pre-existing relationships with its sugar mill clients. For example, when E&Y focused on building their CDM business, they initially approached clients for whom they were already providing auditing services. These clients had an established and trust-based relationship with E&Y and may have been more willing to explore a new business opportunity. In the Brazil case, personal and familial connections between consultants and sugar mill owners were crucial to overcoming the skepticism of a relatively conservative sector (Pulver et al. submitted). Agrinergy had neither family ties nor a pre-existing client base to tap. Instead, they entered into partnerships with various Indian consulting company, including DCSL Energy Services, which itself was a subsidiary of a large industrial group that also owned sugar mills.

A second common element across the Brazil and India cases is the importance of specialized knowledge. Both Econergy Brazil and Agrinergy were convincing in their marketing efforts to clients because both consultancies had written the methodologies on which sugar mills projects were being evaluated. This credibility allowed each consultancy to maximize its project development activities. Econergy Brazil was most successful when projects were being evaluated under AM0015, the methodology they had written. Their activities tapered off once AM0015 was replaced by ACM0006. Finally, the first movers in both markets benefited from being able to point to concrete CDM projects that successfully cleared various stages of the CDM approval process. Registration of bagasse-based power projects at sugar mills had high success rates in being registered by the UN CDM Executive Board. It was not until late 2006 in Brazil and early 2007 in India that the first sugar mill projects were rejected by the Executive Board.



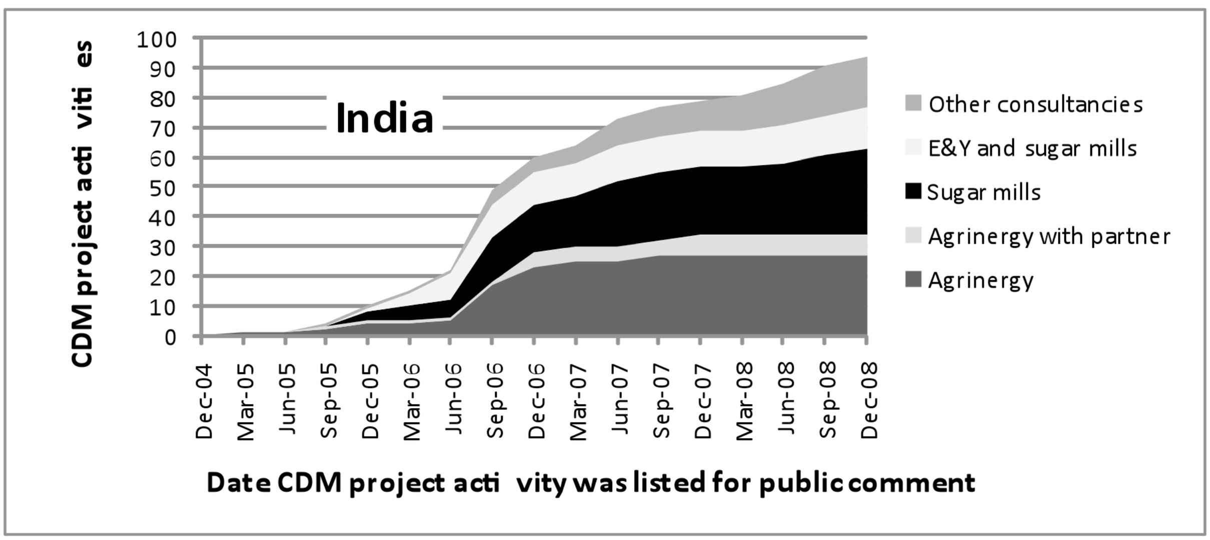


Figure 7. Historical involvement of different consultancies in India and Brazil. Many of India's initial projects were organized by the multinational consultancies of Ernst & Young and PriceWaterhouseCoopers. In contrast, niche consultancies (Ecoinvest and Econoergy) arose in Brazil specifically to undertake CDM projects.

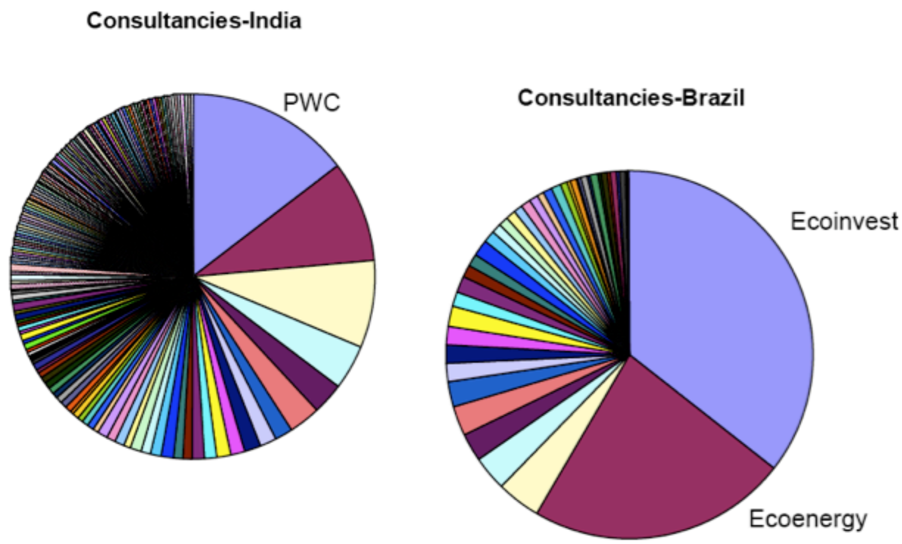


Figure 8. Current distribution of projects in India and Brazil, according to the consultant advising each project. These figures indicate the relatively large market share of the dominant 2-3 consultants (though the market is more concentrated in Brazil), as well as the large total number of consultancies that have entered the market in each country.

While consultants played the primary role in providing technical expertise and information to potential CDM participants, these participants also gained information about CDM opportunities via a number of other information pathways. Participants listed word-of-mouth and media coverage as particularly important in India. The very first CDM project globally to seek registration was a large scale, highly profitable industrial gas decomposition project in Gujarat. This high-visibility and eventually lucrative project was mentioned frequently by interviewees as a clear indicator of potential that caused people in diverse industries to investigate the possibilities in their own facilities. In Brazil, the first projects to be submitted were in fact sugar sector projects (at the Vale do Rosario and Santa Elisa mills) run by a well-capitalized and highly-respected company, which already served as an enterprise to emulate among its peers. In both countries, hundreds of capacity building and informational workshops were held by industry groups, government agencies, and non-governmental organizations. However, few of these seemed to be noteworthy with the exception of the involvement of India's TERI (the Energy & Resources Institute), which holds an unusual position of prestige as an academic think tank with extensive industry and government connections (for example, the current chair of the IPCC is also director-general of TERI).

5. Conclusion

In one sense, Brazil and India represent "success stories" under the CDM: they witnessed rapid and pioneering expansion of the market across multiple sectors, and remain leaders in number of projects, expected reductions, and depth of institutional capacity. But in another sense, the differences of market development in the two countries raise questions about the improving the effectiveness of policy interventions. We have in this paper focused on the sugar sector in these countries to investigate the dominant trends behind this growth. It is clear that, because of the novel and technically abstruse nature of carbon markets generally (and CDM specifically), information pathways were the key to early adoption: those industries and firms with extensive links to expertise were much more likely to adopt successful projects. Two lessons emerge from this analysis. First, in both Brazil and India, relationships to technical experts in the form of consultants were the key to identifying possible projects and to leading these projects through the complex machinations of the CDM. For the most part, these relationships seem largely outside the purview of policy intervention: while government and even some NGOs made efforts to hold capacity building workshops targeted at firms, participants viewed these efforts as marginal to their decisions. In this light, if governments are keen to foster a healthier carbon economy, perhaps a more fruitful approach would be to focus on building expertise in the carbon market practitioners themselves, rather than trying to reach individual firm managers. A second lesson is that differences in domestic regulatory stringency, while clearly meaningful to those firms seeking to pass through the eye of the Brazilian DNA, did not lead to substantial differences in the overall adoption of carbon markets. On the other hand, changes in requirements at the international level did clearly influence the market activity in both countries, essentially shutting off similar projects from one week to the next. Injecting greater predictability into this process would enable a smoother transition for project developers and firms that are considering new initiatives. Further questions remain however, as to how markets evolve differentially across different economic sectors within countries.

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