UC Berkeley
Breslauer Symposium

Title

Sweet-Talking the Climate? Evaluating Sugar Mill Cogeneration and Climate Change Financing in India

Permalink

https://escholarship.org/uc/item/1t17v72h

Authors

Ranganathan, Malini
Haya, Barbara
Kirpekar, Sujit

Publication Date

2005-12-01

eScholarship.org Powered by the California Digital Library
University of California

Sweet-Talking the Climate?

Evaluating Sugar Mill Cogeneration and Climate Change Financing in India

Malini Ranganathan, Barbara Haya, and Sujit Kirpekar

ABSTRACT

International support to help pay the costs of climate change mitigation in developing countries is an essential element of any future international climate change agreement. Analyses of various funding options have focused broadly on their relative ethical justifications, ease of implementation, and cost effectiveness. Yet for the most part, these international climate discussions about the nature of a future international financial transfer mechanism are occurring mostly on a high policy level, without grounded analysis in the places where the resulting activities would take place. Drawing on past experiences, there is a need for more bottom-up analysis regarding the efficacy of various types of assistance in reducing greenhouse gas emissions.

In India, high efficiency cogeneration of electricity and steam from sugar cane waste (bagasse) has been ranked among the highest for its potential for cost-effective emissions reductions and other development and environmental benefits (WRI 2000). India's sugar industry is the largest in the world and employs over 14 million people and 45 million farmers and their families (Winrock 2002). Despite its multiple purported benefits, and numerous domestic and international programs to support the technology, less than 10% of India's estimated potential for bagasse cogeneration has actually been exploited, while approximately 20% of the total potential is in the planning stages (WADE 2004, MNES 2004). Focusing on Maharashtra and Tamil Nadu, two of the largest sugar producing states in India, this research examines the current state of the technology, barriers to its dissemination, and the results of past international and domestic efforts to support it.

BACKGROUND

Overview of India's Energy Sector

The potential benefits of increasing the implementation of bagasse cogeneration can be seen in the context of India's rapidly growing energy demand and predominantly coal-based power supply. The combined impacts of urbanization, population growth, and economic liberalization in the 1990s increased energy consumption by 208% from 1980 to 2001 (EIA 2004). More than half of India's energy consumption is from coal, the majority of which is used for thermal power generation. This is one of the reasons why India's carbon emissions are likely to increase in the coming decades. Currently, it ranks fifth globally behind the US, China, Russia and Japan at 251 million metric tons of carbon equivalent emitted (EIA 2004).[1] While current power generation capacity stands at 112,000 MW, there continues to be a considerable demand-supply gap as well as poor quality of supply (low voltage and grid instability) and transmission and distribution losses amounting to 40% (MoP 2004).

In order to keep pace with rapid GDP growth (recorded at 8.2% in 2003), India has major plans to expand its power sector infrastructure. The government has targeted an increase in capacity of 100,000 MW by 2012, of which 10% is to come from renewable resources. However, India's power sector is severely financially constrained due to a number of reasons, including cross-subsidies to the agricultural sector and high transmission and distribution losses. The vertically integrated state electricity boards (SEBs) have been unable to meet growing demand and provide quality service. To address this, electricity sector reforms have been underway since the early 1990s. The reform agenda involves establishing separate companies for generation, transmission, and distribution, privatizing distribution, and establishing state electricity regulatory commissions (SERCs).

In order to increase the diversity of its energy portfolio, India has made substantial progress in increasing its renewable power capacity. Total grid-connected renewable energy capacity stands at around 4000 MW, of which wind and small hydro dominate. This figure, however, is only a small proportion of India's total resource potential in renewable energy. Overseeing the various policy incentives for renewable energy is the Ministry for Non-Conventional Energy Sources (MNES). Its activities cover policy-making, coordinating various demonstration programs, and implementing fiscal and financial incentives (MNES 2004).

Bagasse cogeneration, a subset of renewable energy, and the focus of this study, has a potential estimated to range between 3500 MW (MNES 2004) and 5000 MW (Winrock 2002, WADE 2004). The next section first provides an overview of the sugar sector, followed by a history of bagasse cogeneration.

Sugar sector and cogeneration technology

India has over 500 sugar mills with nine states (Uttar Pradesh, Bihar, Punjab and Haryana in the north, Maharashtra and Gujarat in the west, and Andhra Pradesh, Tamil Nadu and Karnataka in the south) holding 95% of them. Fifty six per cent of mills are cooperatively owned, while 33% are private and only 11% are state-owned (Winrock 2002). Sugar mills have capacities ranging from 500 tons crushed per day (TCD) to 10,000 TCD. The minimum capacity for new mills established by the government is 2500 TCD. The crushing season lasts around 100-250 days depending on the region and agro-climatic conditions (WADE 2004).

The process of producing heat and electricity from the fibrous waste left over after processing sugarcane (bagasse) is known as bagasse cogeneration. The sugar manufacturing process is well known and has been refined for over a century. After the sugarcane stock is harvested, it is cleaned and crushed. The crushing process is the main consumer of electric power or heat (depending on the type of prime mover). This process produces sugarcane juice which is subsequently chemically treated and then evaporated. The left over fibrous material may be used as a primary fuel for the boilers in the plant. Due to the volume of bagasse involved, boilers typically have large drop furnaces for combustion. The evaporated sugar juice is then crystallized and centrifuged. This produces sugar in a form that is sold to consumers.

Bagasse based cogeneration with the export of surplus power to the grid was pioneered in Mauritius and Hawaii in the early 1960s, and by 1986-87, approximately a quarter of the total electricity generation in these regions was from sugar factories (Morand 2004, Gillett 2001). For export of electricity to the grid, higher pressure (60 bar and higher) and higher temperature (450 degrees C and higher) boilers, and corresponding turbines are needed.

In India, cogeneration was introduced in the 1920-30s in the textile industry, particularly in Mumbai and Ahmedabad (Padmanaban 2004), but without any export of electricity, since the boilers were of much lower pressure. Since the 1980's, sugar mills in India have also been using bagasse based cogeneration systems. However, mills would typically only generate sufficient steam and electricity for their own needs. This could be easily met with low-pressure boilers in the 18-20 bar range operating at about 300 degrees C. The interest in this technology came in the 1980s when the supply of electricity started falling short of demand. This was mostly due to economic growth and inefficiency in the generation system. The sugar industry is attractive for cogeneration because of the following reasons: i) the continuous manufacturing process of sugar (as opposed to a batch manufacturing) is useful for continuous electricity generation, ii) the load to the boiler system is typically constant, producing a steady electric supply, and iii) the pressure of steam used in the process is low, making available higher pressures in turbines for electricity generation. Efficient technologies such as high temperature/pressure boilers for cogeneration are manufactured in India.

The advantages of cogenerating sugarcane waste and exporting surplus power to the grid are that: i) there is net zero emission of carbon dioxide since the carbon dioxide that is taken up during photosynthesis is released when bagasse is combusted, ii) sale of electricity provides remuneration to the mills that are a large source of employment and social services in rural India, and iii) decentralized sources of electricity supply reduce efficiency losses.

Current Support For Renewable Energy In India

Favorable terms of financing for purchase of renewable energy technologies are provided through the Indian Renewable Energy Development Agency (IREDA), established under MNES. IREDA and MNES also receive funds from multilateral and bilateral funding agencies from which it on-lends to renewable energy projects. For example, to date IREDA has received a $145 million line of credit from the World Bank-Global Environmental Facility, $100 million from the Asian Development Bank, and $15 million from the Danish Government (IREDA 2004). In our methods section, we provide a more detailed summary of the specific MNES/IREDA programs that target bagasse cogeneration. More details about the experience to date with these funds is provided in our findings section.

In our project, we focused on the results to date with two mechanisms established under the international climate change regime: the Clean Development Mechanism (CDM) and the Global Environmental Facility (GEF). These mechanisms were established as a result of the United Nations Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997). The mechanisms offer a way for developing countries to access funds for greenhouse gas abatement activities. However, after several decades of mixed experience with renewable energy projects in developing countries, it is worrisome that researchers and policy-makers alike have raised concerns about the efficacy of these two mechanisms. Further details about the workings of these mechanisms are provided in our methods section.

STUDY DESIGN AND METHODS

Research Methodology

Our study involved a detailed literature review followed by interviews and site visits. We first determined the range of funding support a given sugar mill can receive for implementing bagasse cogeneration. We then selected mills that sourced their funding from a combination of international and domestic sources, those that only used domestic financing, and those that have not as yet implemented the technology. We also interviewed experts from NGOs, energy consulting firms, and international and governmental organizations about perceived barriers to further penetration of this technology in New Delhi, Pune, Chennai and Bangalore.

While in India, we visited individual cooperative and private mills in order to gather first hand information about the barriers actually faced during implementation if they have installed cogeneration units, and if they haven't, the reasons for not having done so. In the process, we interviewed a number of mills with very different circumstances, ranging from highly profitable private mills, to loss-making mills running for very few days in the crushing season. The process by which we determined the information is described in Figure 1.

Figure 1. Interview process

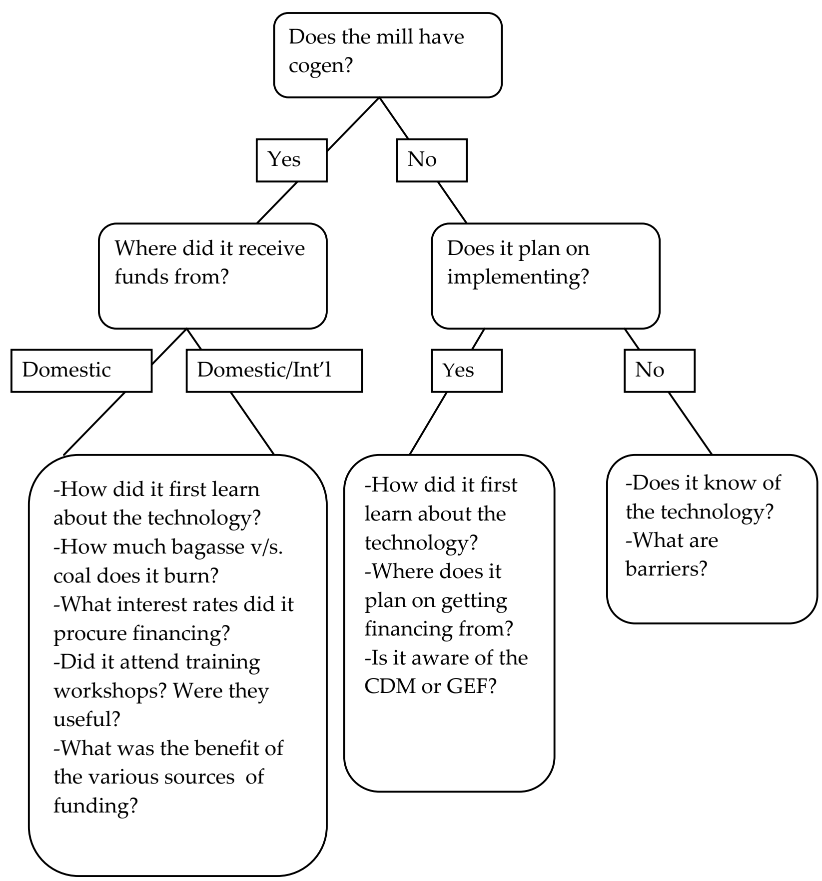

Table 1. Case Studies and their Sources of Funding

Funding Mechanism	*Type of support*
Ministry of Non-Conventional Energy Sources / Indian Renewable Energy Development Agency	Interest subsidy, capital subsidy, workshops, pilot projects, lower customs duty for importing technologies
Local banks	Low interest loans
USAID	Up to 10% equity contribution, workshops, newsletters, "stamp of approval"
CDM	Creates emissions reduction credits
GEF	Proposed financing schemes for cooperatives

Case Studies

The sources of funding we examined in our case studies are listed in Table 1.

Some mills had received funding from a mixture of sources, including domestic and international sources. A listing of all mills we interviewed, their location and funding portfolio (mixed or domestic) are listed in Table 2.

Ministry of Non-Conventional Energy Sources/Indian Renewable Energy Development Agency Projects

In 1992, the national program on Promotion of Biomass Power/Bagasse based Cogeneration was launched, which involved 12 demonstration projects in the cooperative/state sugar mill sector, as well as biomass resources assessment studies, training, and assistance to states in formulating their power purchase policies. This program was revised subsequently to include a capital subsidy for cogeneration projects in the cooperative/public sector sugar mills of Rs 3.5-4.5 million/MW depending upon the level of pressure of the boiler. It also included interest subsidies for commercial biomass power projects at 2-3% or 1-3% depending on the category of biomass and pressure of the boiler. Financial support was also available for research and development projects (Winrock 2002). MNES also conducted a number of pilot projects in mills. We looked at the impacts of these promotional strategies with respect to Jawahar SSK, a cooperative sugar factory in Maharashtra.

A brief description of the funding sources specifically for bagasse cogeneration projects is provided below.

Table 2. Mills Interviewed

Name of mill and location	*Ownership type*	*Amount of cogeneration installed (MW)*	*External funding source*
Ajinkyatara, Maharashtra	**Cooperative**	**0**	**n/a**
Jawahar, Maharashtra	**Cooperative**	**25.5**	**MNES**
Hutatma, Maharashtra	**Cooperative**	**0**	**n/a**
Pravara, Maharashtra	**Cooperative**	**0**	**n/a**
Baramati, Maharashtra	**Cooperative**	**0**	**n/a**
EID Parry's, Tamil Nadu	**Private**	**24.5**	**USAID, MNES/IREDA**
TA Sugars, Tamil Nadu	**Private**	**110**	**USAID, MNES/IREDA, proposed CDM**
Rajshree Sugars, Tamil Nadu	**Private**	**15**	**None**
Chengalryan, Tamil Nadu	**Cooperative**	**0**	**n/a**

USAID Project

The objective of USAID's project "Alternative Bagasse Cogeneration" (ABC) was to demonstrate high efficiency cogeneration technology in the Indian sugar sector, and to use bagasse as a fuel to replace fossil fuels normally used by fuels during the off-season. To achieve climate benefits, USAID aimed to have year-round operation of sugar mills on biomass fuels alone. ABC was part of a 10 year, $39 million activity (1995-2005) known as the "Greenhouse Gas Pollution Prevention Project". The project selected nine mills that were screened for financial viability. The criteria were that the mills had to be above 2500 TCD, and had to install boilers that were 60 bar and 480 deg. C or above. They also had to operate for 270 days per year. Of the nine mills that were selected, we interviewed two – EID Parry's and TA Sugars in Tamil Nadu.

The Clean Development Mechanism and Global Environment Facility

The CDM, one of the flexibility mechanisms of the Kyoto Protocol, is a project-based emissions trading mechanism that allows industrialized countries to fund emissions reducing projects in developing countries and use the resulting carbon credits towards their own domestic targets. At present the CDM is transitioning from its pilot phase to registering its first official projects. India is currently leading the world in terms of the numbers of CDM projects being proposed. Three of the first CDM projects proposed were bagasse cogeneration projects in India.

The GEF was established in 1992 to support activities in developing countries that have positive benefits on global environmental problems. The GEF funds the "incremental costs" of new activities, or the additional costs of performing an activity above what would be paid otherwise by the developing country. For example, the incremental cost would be the difference in capital requirements to build a 20 MW wind farm instead of a 20 MW coal-fired power plant. The GEF also provides technical assistance grants (for instance, it has provided $5 million to IREDA (IREDA 2004)).

Both of these mechanisms have been criticized. The GEF has been criticized as being bureaucratic to work with, slow in processing projects, and having project criteria that seem far removed from on the ground realities (e.g. Horta 2002). The CDM has been criticized for how difficult it is to estimate the emissions reduced by CDM projects. Critics describe the CDM as producing carbon credits when no emissions are reduced, or allowing for the exaggeration of the amount of reductions from a project (e.g. Haya 2002). We explore these concerns with case studies of CDM and one GEF project focused on bagasse cogeneration in India.

PRINCIPAL FINDINGS

Barrier Analysis

Our analysis in the field shows that there are multiple barriers to the implementation of bagasse cogeneration in India as a source of renewable energy based electricity (as has also been documented in Smouse (1998)). The barriers exist at different levels, e.g. the national, state and local level, and are often inter-related. Our interviews show, that the initial barriers were due to the lack of familiarity with the technology, but a decade after the USAID project started (1995), mill owners we interviewed were widely aware of the practice of cogeneration with export to the grid. Clearly, barriers to this technology will also change in the future, especially due to the changing structure of the power sector in India. We present here an analysis that aims to collectively bring out the fundamental barriers and their possible transformation in the future. The discussion that follows addresses how compatible current financial mechanisms are with local circumstances.

Information Barriers

Through a variety of training programs and newsletters, the USAID project was able to address the initial barriers arising from lack of information about the technology for a majority of mills. A number of mills that we interviewed mentioned that they were aware of the USAID project, and had even attended a training session. Winrock India was responsible for bringing out a series of newsletters titled "Cane Cogen India" which provided updates on policy announcements, and projects implemented by mills in both the cooperative and private sectors (even though the USAID project did not address the cooperative sector.)

Financial Barriers

In spite of the fact that India has made remarkable progress in the production of sugar, the sugar industry in India is in a dire situation. India has gone from being the world's third largest producer of sugar in 1976 to the 2nd largest producer in 2003. India and Brazil continue to switch off for the first position. The area under cultivation has also increased more than two-fold (Godbole 2000). However, the productivity of the industry has steadily been declining. The per-hectare yield of sugarcane has decreased in all states except Tamil Nadu, and is close to half the international average. This decline in productivity goes against Indian sugar manufacturers in the international marketplace, although most sugar is currently domestically consumed. Further, fluctuations in the weather (especially the occurrence of drought) and fluctuations in the demand for sugar have been responsible for the difficult financial situation that the mills face today.

Experience with bagasse cogeneration in the USAID project has proved its merit of being a profitable technology. Our interviews with EID Parry and TA Sugars, two of the nine mills that implemented bagasse cogeneration in the USAID project, indicate that the project provided a steady flow of revenue with preferred taxation and interest policies. These mills also indicate that a major source of its revenue is now from the sale of electricity, and the production of energy is not treated as a secondary business to the production of sugar.

Mills that have not implemented bagasse cogeneration typically face difficulty accessing the necessary capital – a major barrier to the widespread use of this technology. Most financial institutions are hesitant to lend to private mills (we treat cooperative mills separately) because of the high risk involved. Bagasse cogeneration projects conventionally require investment of 1 billion Rupees, while smaller allied projects, e.g. alcohol distilleries, ethanol producing plants, require an investment of only 10 million Rupees (Bhosale 2004). Our interview with a mill owner in Satara, Maharahstra indicates that such smaller projects are often successful at attracting the requisite finance, but bagasse cogeneration requires an order of magnitude investment that banks are not willing to risk.

Regulatory Barriers

A second major barrier to the dissemination of bagasse cogeneration is regulatory uncertainty. In 1994, MNES started programs for the promotion of bagasse cogeneration. These programs offered capital and interest subsidies, research and development support, accelerated depreciation of equipment (e.g. boilers, turbines, waste heat recovery systems), a five year income tax holiday, and excise and sales tax exemptions (MNES, 2004). MNES also prescribed guidelines (without enforcement) to the State Electricity Boards as to the tariffs they should offer for renewable energy power, based on which, several states independently announced policies for electricity purchase from bagasse cogenerators.

Starting with the 1996 Orissa Electricity reform act, the 1998 Central Electricity Regulatory Commissions (CERC) Act and finally Electricity Act of 2003, the Indian power sector is seeing widespread changes in its structure. State level electricity regulatory commissions, setup under the supervision of the CERC, have been successful in formulating policies for buying electric power from bagasse. However, this reform process has caused previously signed contracts to be over-ridden, slowed down the implementation of these contracts and several states have reneged on their power purchase agreements.

Many sugar mill owners report that state electricity boards have historically not been credit worthy, which makes project developers cautious about implementing large bagasse cogeneration plants.

The prospects of overcoming regulatory barriers are certainly favorable. The state of Maharashtra is in the process of unbundling its state electricity board into generation, transmission and distribution (it has taken serious steps to do so in the last 5 years). The state regulatory commission has consistently issued tariff orders through democratic public participation, and has made the state electricity board more accountable. Due to this, the SEBs are less likely to rescind their power purchase agreements with bagasse cogeneration mills. Furthermore, the Electricity Act allows for the creation of open access to the grid. At least one private company (Indal Ltd.) has been allowed open access to the grid owned by the Karnataka SEB. This would give sugar mills the opportunity to sell power to customers directly, while they would only pay wheeling charges to the SEB.

Cooperative Sector

Background

In 1998, 55% of sugar mills in India were in the cooperative sector, with about 45% of them in Maharashtra. These mills accounted for 60% of total sugar production in India (Godbole 2000). The cooperative structure has a democratic framework that allows the election of its governing board. Since members of the cooperative boards are elected every five years, rival factions (often associated with national political parties) are in pursuit of popularity among voters. These voters are mainly the shareholders of the cooperatives of which cane producers in the vicinity of the factory form the majority. In addition to having a local political system, the cooperative sugar sector is also the most influential agricultural government lobby group. Most often, local cooperative leaders are actively involved in politics at the state and national levels. They provide political advantages to the regions they represent, hence some sugar producing regions in rural Maharashtra (e.g. Baramati, Satara) have seen rapid economic development. It is now common for sugarcane producing regions to have primary schools, professional colleges for engineering and medicine, modern hospitals and modern IT and communication infrastructure. This economic development has been possible due to the political role these regions play in the state and national government.[2]

The political link of the sugar community has made it possible for the industry to gain some of the highest agricultural subsidies. In spite of this more than one-third of the co-operative sugar factories in the Maharashtra have been loss-making for the past three years, or are running at less than 75% of their capacity. The state government of Maharashtra is regularly a guarantor for large loans from financial institutions for the cooperatives. In addition, the state government has equity participation (usually 3 to 5 times the share of the cooperative members), and provides tax loans and other loans to the cooperatives. The state government is also lenient in prescribing terms and conditions of these loans. Three state government committees were established over the last 20 years to investigate possible solutions to the loss-making status of the sugar industry, and all three committees prescribed generous relief measures.

The cumulative outstanding dues from the sugar industry were Rs. 2.54 billion in 1998 (Godbole 2000). The national government has recognized that "the cooperative sector is proving to be against the spirit of competitiveness and professionalism" and is prescribing stringent restrictions for the state government's equity participation in sugar mills.[3]

Barriers In The Cooperative Sector

From the above analysis, it is evident that the primary barrier to bagasse cogeneration in cooperative sugar mills is their financial weakness. Sugar cooperatives have been an excessive burden on the state exchequer and have defaulted on loans running into millions of Rupees. For this reason, financial institutions run by the national government and other private financial institutions have declined any further lending to the cooperatives. Although our field research shows awareness of the practice of bagasse cogeneration, the financial health of the cooperatives has prevented them from seeking the necessary investment for such projects. Thus the institutional practices of the cooperatives and their poor financial health have prevented them from making the investment in technology upgrade that some of their private counterparts have been able to make.

Our interviews called our attention to the lack of competitiveness and risk taking attitude in the management of some sugar mills. There are also procedural difficulties, *i.e.* only businesses that are shareholders of the cooperatives can engage in certain business transactions with the mills. This restricts which businesses can, for example, provide machinery, maintenance, warehousing, etc., to the mills. Private companies are also not willing to take investment risks with sugar cooperatives because there is a high chance of policy change if a new management board is elected in the next elections.

However, we also interviewed two cooperative mills that show promise of future investment in bagasse cogeneration. One example is the Jawahar Cooperative Factory in Maharashtra that has installed 24 MW of high efficiency cogeneration. They attributed their move to install the technology to an initial pilot project funded by the MNES in the early 90s. Although they cited initial problems with evacuating power to the grid, they are now quite satisfied with their contract with the Maharashtra SEB.

Another mill we interviewed was the Hutatma Cooperative Sugar Factory. Hutatma is a "model" cooperative, combining aspects of democratic governance, transparency, environmental soundness, and high efficiency in terms of sugar recovery. Hutatma does not have cogeneration installed as yet, but is aware of the technology and expressed desire to install it once it was more financially secure (Hutatma, like Jawahar is not loss-making, but still does not feel it has enough capital to invest in the technology). Interestingly, we discovered that Hutatma's success can be attributed to the leadership of a visionary freedom fighter and social activist, by the name of Nagnath Naikodi.

Essentially, cooperatives act in the best interests of their shareholders. Although the international financial mechanisms we have discussed provide equal opportunities to private and cooperative mills, there is a higher tendency for private mills to seek such funds, and conversely an inclination for the funding agency to select private mills in favor of cooperatives. As is the case with any bagasse cogeneration project in India, use of bagasse as a renewable energy source is not a motivating factor in selection of projects.

Another promising approach to implementing such projects is the Build-Own-Operate-Transfer (BOOT) method, e.g. implemented at the Pravara Sugar Factory in Maharashtra. While such approaches have been successful only in a few specific projects, they are promising candidates for future cogeneration projects.

From the above analysis of the institutional and political nature of the cooperatives and the subsequent financial barriers they face, it is clear why international agencies have not been more forthcoming in engaging this sector. The "un-corporate" culture of cooperatives is something international agencies are not used to, which is why they have focussed on the more profitable private mills. However, if any substantial progress is to be made in this technology, the cooperative sector will have to be tapped. For instance, out of the 5000 MW estimated potential, 1250 MW lies in Maharashtra, of which 99% is in the cooperative sector. There is a hence a substantial gap between the physical potential of bagasse cogeneration and the realizable potential. There is much work to be done to bridge this gap.

From our personal interviews, we learned that GEF's new project "Removal of Barriers to Biomass Power" aims to provide innovative financing for cooperatives. However, there appears to be substantial delay in the implementation of this project (Natu 2004).

Chief Criticisms of Projects

Criticisms of the CDM

As described, under the Kyoto Protocol the primary mechanism involving developing countries in emissions reducing activities is the Clean Development Mechanism (CDM). The CDM allows industrialized countries to help fund projects in developing countries that reduce emissions, and apply the resulting carbon credits towards their own domestic targets. Calculating GHG emissions reduced by a project requires estimating what would have happened, and what additional emissions would have been produced, in the absence of that project. One of the main concerns about the CDM is the ability to test if a project is "additional," that is, if the generation of carbon credits enables a project to happen which would not have gone ahead otherwise and therefore represent real emissions reductions. Through discussions with project developers in India and elsewhere we have witnessed numerous examples where CDM project developers view the CDM as a potential additional source of profits for projects they are already planning to build. In testing common additionality arguments used, we find that many are not verifiable. What this means is that the CDM is likely producing fake carbon credits, allowing industrialized countries to increase the amount of emissions while not reducing developing country emissions. Because of the difficulty in assessing project additionality, the CDM can be understood more as a subsidy for the activities allowed under it, rather than an emissions trading mechanism. Thus we have not found evidence from the bagasse cogeneration case or others that the CDM will make a real dent in the levels of emissions unless it is able to reach out to projects that would not have occurred in the absence CDM funds.

Criticisms of multilateral lines of credit

One of the main problems cited with multilateral lines of credit are the high lending rates which IREDA receives loans from ADB, the World Bank and other agencies. These high rates then translate into high on-lending rates by IREDA for renewable energy projects (Reddy 2004). We were told that this is the major reason why projects originally appraised and financed by IREDA with interest rates of around 13% are now being refinanced by local financial institutions at much lower interest rates.

Mismatched goals

One debate in discussions about the future financial transfer under international climate agreements is how climate and development benefits are to be weighed against one another. Within the climate policy literature, some argue that climate projects have the potential to have significant synergies with other domestic development goals (Davidson 2003), and are more likely to be successful if they also address these other goals (Swart 2003). Others argue that the climate regime would collapse under its own weight if designed to address climate and development needs simultaneously.

One conclusion of our study is that if domestic development goals are not taken into account in project choice and design, projects that bring about climate benefits may run into conflicts with other more pressing domestic goals. We see two examples of this with our case study bagasse cogeneration projects.

In areas of Tamil Nadu, due to drought and the high price of biomass, paper mills are paying high prices for sugar cane waste. As a result, some sugar mills including some supported by the USAID project, are selling all of their bagasse to the paper factories and burning coal instead. They choose to do this because the profits from the sale of bagasse to paper mills are higher than the profits from the sale of electricity to the grid. What this means is that the USAID project meant to support emissions reductions through the implementation of bagasse cogeneration, may have instead enabled the mills to burn more coal (the old boilers could not burn coal cost-effectively) therefore leading to an increase in emissions. This situation is most likely temporary, lasting only as long as the price of biomass remains high.

A second example of a conflict between goals is the interest of SEBs to remain solvent on the one hand, and the national goal of increasing the renewable energy share on the other by issuing guidelines for providing higher tariffs to electricity generated by renewable energy. In both Tamil Nadu and Maharashtra the state electricity boards went back on their contracts with bagasse cogeneration and wind power plants because they are in financial difficulty and resent the higher prices they are contracted to pay for renewable energy. This produces a regulatory climate that is less certain for new renewable energy plants.

In summary, our findings are:

1. The USAID project increased confidence in the technology by providing a "stamp of approval". However, some of the private mills claimed that they would have installed the technology regardless of any foreign support. Moreover, no cooperative mills were funded under the USAID project. The difference in working culture between international and domestic organizations, coupled with the low financial viability of the cooperative sector make them a difficult candidate for outside support. Yet, a substantial portion of the total capacity for cogeneration lies with the cooperative sector (Maharashtra alone accounts for a fifth of the total potential.)
2. Within the cooperative sector, strong and transparent leadership seemed to be key in making the mill successful. Such mills are likely candidates for future projects.
3. The CDM is an inherently flawed mechanism. While it is true that some mills may take advantage of the funding, these projects may not be additional to what would have happened anyway, defeating the purpose of the mechanism.
4. Multilateral lines of credit are expensive. IREDA receives these loans at high interest rates and hence has higher interest rates than local banks, leading to many projects being refinanced.

However, a positive outcome is that the availability of these funds allowed IREDA to appraise certain projects and provide a nurturing role. Perhaps it is apt now that local banks take over.

5. There has been notable success in implementing bagasse cogeneration projects through the initiative of local consulting firms such as, Maharashtra Energy Development Agency (MEDA) and MITCON.

CONCLUSIONS

We conclude that the success of projects to support bagasse cogeneration is affected by the specific context in which they are implemented. We found layers of financial, regulatory, and informational barriers to the dissemination of bagasse cogeneration. Also the barriers changed over time, were different between the two states, and differed significantly between the private and cooperative sectors. Any project aimed at a single barrier had limited success on its own. Also, energy interventions in large industrial, or agro-industrial sectors in a developing country face obstacles due to institutional and political conditions and linkages with other important factors, such as labor, agriculture, trade, electricity. Where international and domestic priorities differ, such as in the context of international efforts to support climate change mitigation in India, projects that bring about international goals may run into conflicts with other more pressing domestic goals. Any effort to exploit the remaining 90% of the estimated national potential will need to address the special financial and political circumstances of cooperative mills. Our research indicates that barriers to the adoption of cogeneration in cooperative mills are largely financial and institutional.

M Ranganathan and B Haya are PhD students in the Energy and Resources Group, University of California, Berkeley. S Kirpekar is a PhD student Mechanical Engineering, University of California, Berkeley.

NOTES

[1] However, India's per capita carbon emissions are 22 times lower than that of the US and less than one quarter of the world average (EIA 2004).

[2] For a detailed account of the political economy of Maharashtra we refer the reader to (Baviskar 1980) and (Attwood 1992).

[3] For further data about the financial condition of sugar mills in Maharashtra, we refer the reader to (Godbole 2000).

REFERENCES

Attwood, D. W. (1992). Raising cane: the political economy of sugar in western India, Westview Press.

Baviskar, B. S. (1980). The politics of development: sugar co-operatives in rural Maharashtra, Oxford University Press.

Bhosale, Abhayraje S. (2004). Personal Communication.

Davidson, Ogunlade, Kirsten Halsnaes, Saleemul Huq, Marcel Kok, Bert Metz, Youba Sokona, and Jan Verhagen. 2003. "The Development and Climate Nexus: The Case of Sub-Saharan Africa." Climate Policy :S97-S113.

Energy Information Administration, US Dept of Energy. 2004. http://www.eia.doe.gov/cabs/indiaenv.html#carbemis

Gillett, J. (2001). Report of the First National Forum on Small-Scale Renewable Energy in Belize.

Godbole, M. (2000). "Co-operative sugar factories in Maharashtra - case for a fresh look." Economic and Political Weekly 35(6): 420-424.

Haya, Barbara, Patriick McCully, and Ben Pearson. 2002. "Damming the CDM: Why Big Hydro is Ruining the Clean Development Mechanism." International Rivers Network, Berkeley, CA.

Horta, K., Round, R., Young. Z. 2002. "The Global Environmental Facility, the First Ten Years - Growing Pains of Inherent Flaws?" Environmental Defense, Halifax Initiative, Conscious Cinema.

MNES (2004, February 8). Ministry of Non-Conventional Energy Sources. http://www.mnes.nic.in/

MoP. 2004. Ministry of Power. www.powermin.nic.in. Accessed 11/7/2004

Morand, A. (2004). Bagasse Cogeneration -- Global Review and Potential, World Alliance for decentralized energy (WADE).

Padmanaban, S. (2004). Personal Communication.

Reddy, BVK. 2004 Personal communication.

Smouse, S.M. (1998); Staats, G.E.; Rao, S.N.; Goldman, R.; Hess, D., "Promotion of biomass cogeneration with power export in the Indian sugar-industry" Fuel processing Technology. pp. 227-247

Srinivasan, G. 2004. The bittersweet saga of sugar. Available at www.kisanwatch.org Accessed 8/29/04

Swart, Rob, John Robinson, and Stewart Cohen. 2003. "Climate Change and Sustainable Development: Expanding the Options." Climate Policy :S19-S40.

TERI 2003. International Conference on Electricity Regulation: addrssing the special concerns in developing countries. Conference proceedings.

TERI. 2000 Survey of Renewable Energy in India. The Energy and Resources Institute, New Delhi.

WADE 2004. Bagasse Cogeneration – Global Review and Potential. Edinburgh, World Alliance for Decentralized Energy.

WRI (2000). India: CDM Opportunities and Benefits in Financing Sustainable Development with the Clean Development Mechanism by Pathak, M., L. Srivastava, S. Sharma. World Resources Institute. Washington, DC.