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The Brazilian electrification program LPT (Light for All) – what lessons have been learnt?

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The Brazilian government aims to provide complete electricity coverage for all citizens as a means to promote development. Between 2003 and 2009, 11 million people have benefited from the electrification program Light for All (LPT). This article describes research on the lessons learned from the Brazilian experience for other developing countries.

Brazil is approaching universal electrification as a result of its electrification program called LPT (Light for all). LPT was created in 2003 with the main goal of reaching full electricity coverage in the country. So far, 11 million people have benefited from the program at national level, 2 million of which live in the Amazon region.

Measuring Progress

The success of policies for electricity access cannot be measured only in terms of the number of connections. Instead, the impact of electrification on development must be determined as a way to justify resource allocation and confirm welfare improvement. Accordingly, the Brazilian government uses the HDI (Human Development Index) as a tool for planning and monitoring development policy, including electrification. A clear trend of improvement in the HDI has in fact been observed in Brazil in recent years (see Figure 1). According to the Ministry of Mines and Energy, about 280,000 new jobs have been created as a result of the LPT. A recent survey performed by Zaytecbrasil confirms the impact of LPT: 91% of respondents (about 3500 families) attached electricity access improvement to a better quality of life. The arrival of electricity facilitates social programs related to health services, education, water supply and sanitation among others which strongly affect the HDI.

Although two million people have been connected through grid extension, one million inhabitants still lack electricity access in the Amazon. The Brazilian Amazon has about 4 million rural inhabitants thinly spread (about 4 inhabitants/km2). Electricity exclusion is still a problem despite the efforts made in the LPT (see Figure 2). Prospects for further grid extension do not exist and a new scheme is required to promote electricity inclusion. To address that, the LPT administration has recently launched a handbook with a set of technical and financial procedures, including decentralized renewable energy based systems.

THEME ISSUE: Rural energy, climate and development

Electricity access: key for promoting sustainable development

The recognition of the role of electricity access in addressing and achieving development goals has been important for the mobilization of political will and definition of policies to promote full coverage in Brazil. LPT is treated as a key component of the national strategy for poverty reduction and sustainable development. Electrification promotes new jobs, income generation and overall welfare improvement.

A typical house and inhabitant living in the Amazon region; providing electricity to these households is still a challenge to Brazilian authorities.

Photos: María F. Gómez

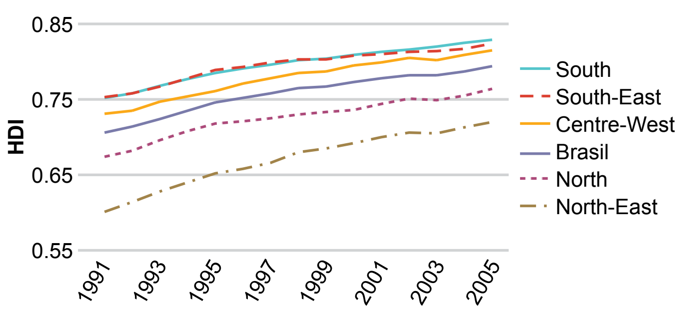

Figure 1. Human Development Index for Brazil and the country's five macro-regions

Source: see end of article. Note: The North region, as defined in the macro-region division of Brazil, can be considered equivalent to the Brazilian Amazon region.

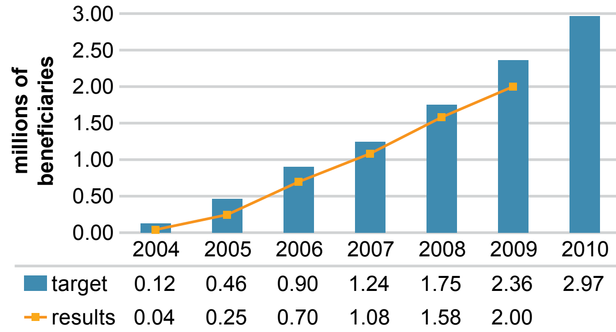

Figure 2. Accumulated LPT's targets and actual results in the Amazon region

Source: see end of article. Note: The targets in terms of number of beneficiaries were calculated from the official targets based on number of connections and the average number of inhabitants per household (3.7). We consider one electricity connection per household unit.

The significance of citizen involvement

A strong link between policies and local citizens that is supported by well-defined planning and monitoring tools is central to the success of electrification policies. Citizens have to be part of the electrification process and not only ultimate beneficiaries to improve the effective and prompt responsiveness of the electrification model to local realities.

The institutional and legal framework

Brazilian authorities have transferred the implementation responsibility to the appropriate stakeholders with well-defined guidelines. The LPT created a priority level based on social welfare as measured in the HDI which is also used to monitor and evaluate the program. The compulsory completion of specific and prioritized targets by the electricity companies has promoted the development of projects that had previously low priority at the company level.

The challenges ahead

The results of LPT can be considered a great achievement for a nation that has recently been considered as a developing country. However, one million people still lack electricity in the Amazon. While the situation has apparently been recognized by the government and alternative solutions are being explored, established concepts for devising and effectively monitoring decentralized electrification systems are still to be further developed. Other challenges ahead include concerns on the economic and social sustainability of the electrification system being put in place. LPT results are encouraging, but key issues related to efficiency, quality and costs of the services need to be addressed.

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Medium-scale gasification plant, GP Green Energy Systems Pvt Ltd.

Small-scale biomass gasification: Asian experience and options for future deployment

Prof. Sribas Bhattacharya, President, International Energy Initiative

Small-scale biomass gasification offers an important technology option that can be deployed in rural areas and make contributions to the local economy as well as to climate mitigation. In this article, an historical overview is given on the deployment of biomass gasification systems and the techno-economic challenges that have been encountered, with special emphasis on the experiences in India and other Asian countries.

Producer gas, a combustible mixture of gases produced by gasification of carbonaceous materials, *e.g.* biomass and coal, has been used in various applications for many decades. Small-scale gasifiers have been used for transport, thermal, and power applications.

History of gasification in Asia

During WWII, small gasifiers were used for powering vehicles in China, India and Japan; the number of producer gas vehicles in 1942 in India and Japan was estimated at 10,000 and 100,000, respectively (NRC, 1983). Interest in gasifiers diminished considerably after WWII as cheap oil became available. China continued to develop gasifiers; many rice husk gasifiers of various designs and sizes were installed in the 1950s in rice mills to provide shaft power.

The energy crisis of 1973 triggered a great deal of interest in gasifiers in many Asian countries. In Thailand, a variety of applications were demonstrated, including electricity production, irrigation water pumping, agricultural drying and process heat for small-scale agro-industries. By the late 1980s, there were 143 charcoal gas-

ifier units in remote areas and 23 open-core rice husk gasifier units for electricity production (Kjellström, 1990).

In the Philippines, a gasifier programme was launched in the early 1980s, including evaluation of gasifier-powered fishing boats, irrigation pumps, and power generators (NRC, 1983). A government-owned company (GEMCOR) manufactured about one thousand gasifiers, mainly for agricultural cooperatives (Stassen, 1995).

Indonesia started a significant programme on biomass gasification in the 1980s. A total of 49 gasifiers were identified by a survey carried out in 1989 by Biomass Gasification Monitoring Program (BGMP) sponsored by ESMAP (Stassen, 1995); these consisted of 16 research/pilot reactors, 24 power gasifiers and 9 industrial thermal gasifiers. While all the power gasifiers were demonstration projects, the thermal gasifiers were all purely commercial; the survey found that only 11 of the 24 power gasifiers and 7 of the 9 thermal gasifiers were actually operational.

Development of small-scale biomass gasifiers in India began in the early 1980s; the focus was on small gasifier-engine systems for pumping irrigation water. India's Biomass Gasifier Programme was launched in 1987 using fairly high subsidies and focusing on development and demonstration for pumping water and power generation.

The oil price crash of 1986 dealt a severe blow to gasifier programmes in most Asian countries, except China and India. Around 1990, China initiated efforts to develop gasifier stoves as a means of addressing the problem of smoke from conventional biomass-fired stoves.

Biomass gasification in India

In India, biomass gasifiers for power production are normally used to run dual-fuel diesel engines, with about 75% diesel replacement; 100% producer gas engines have also become available in recent years. As a result of two decades of government support, biomass gasifiers of capacity up to 500 kW are now commercially available.

The total installed capacity of biomass gasification-based power generation in the country so far is about 110 MW. The Indian Government currently provides support for three types of gasifiers:

1. Biomass Gasifier based Distributed / Off-grid power programme for Rural Areas;
2. Biomass Gasifier based Grid Connected Power Programme; and
3. Biomass gasifier based programmes in Rice Mills.

The cost of electricity based on biomass gasification depends on a number of factors, *e.g.*, capital and maintenance costs, biomass cost, load factor etc. For gasifier operation in remote areas, the cost is significantly higher in applications with low load factor. The cost of gasifier-based captive power generation based on both dual-fuel and gas-only operation is normally significantly lower compared with pure diesel fuel operation.

Thermal gasifiers

Although gasifier use for power applications has attracted most attention in India, their use for thermal applications appears to be much more attractive. A study estimated payback period for replacing liquid fuel or traditional biomass fired systems by gasifier systems for these applications to be 6 months and 2 years, respectively (Ghosh *et al*., 2004).

The Energy and Resources Institute (TERI) of India has developed a gasifier stove for commercial applications, *e.g*., silk reeling and cardamom drying; TERI gasifier stove has also been demonstrated for tobacco curing application in Myanmar. British Petroleum together with the Indian Institute of Science in Bangalore developed a pellet-fired gasifier cooking stove that is now in commercial use, the Oorja smokeless stove (BP, 2007). A few other gasifier stove designs are currently in different stages of development and commercialization; these include Sampada Gasifier Stove and Philips Woodstove.

Technological maturity

India has the largest small-scale gasifier programme in the world and Indian manufacturers export biomass gasifiers to a number of countries. However, there have been difficulties regarding satisfactory testing and certification system for gasifiers; there is a need for independent assessment of gasifiers operating in the field to establish the nature of the operational problems faced in running gasifiers and estimate the percentage of the installed units actually operating.

The technical problems of power gasifiers are mostly because of tar in the gas. The tar remaining in the gas after scrubbing and cleaning tends to condense in the engine manifold and inlet valves and necessitates regular cleaning of the system for reliable operation. That is the reason why gasifiers normally need to be attended to and maintained by skilled labour for smooth and satisfactory operation. The gas cleaning system is based on water scrubbing; the contaminated water produced on cleaning the raw producer gas is often disposed unsatisfactorily.

Photos: J. Mukherjee.

Medium-scale gasification plant, GP Green Energy Systems Pvt Ltd.

Highlights of biomass gasification in the rest of Asia

Biomass gasification appears to be well-established in China, where the installed capacity was 60 MW at the end of 2008. In China, technology for downdraft gasification of agricultural residues has been developed to supply gas for cooking to household users.

As a result of rising oil price in recent years and growing concern regarding climate change, interest in biomass gasification has started to grow again internationally although gasifier dissemination still lags far behind other technologies. Gasifier stoves, which were originally developed in China, have also been developed in Cambodia, Nepal, Thailand and Sri Lanka.

Figure 3 shows a schematic of a natural cross-draft gasifier stove developed at the Asian Institute of Technology (AIT) in Thailand under a project funded by the Swedish International Development Cooperation Agency (Bhattacharya and Kumar, 2005). Air is sucked into the gasifier under natural draft and gasifies the biomass fuel inside the reactor. Gas enters into a burner where it burns on contact with secondary air. The fuel for the stove can be small wood pieces or broken biomass briquettes. The fuel is loaded into the fuel chamber of the stove from the top, which is normally kept closed using a lid dipping into a water seal. By loading fuel as needed, it is possible to run the stove continuously.

The AIT gasifier stove has been disseminated in the region through workshops and training programs; a slightly modified version of this stove has been developed in Nepal. The gasifier stove of Cambodia, called the Vattanak stove, has been developed by a local NGO and is used for palm sugar making.

Conclusions

Biomass gasification is well-established in India and China; interest in the technology in a number of other Asian countries has also been growing.

So far, the major emphasis has been on power gasifiers; however, thermal gasifiers appear to be more attractive in terms of economics and reliability. Gasifier stoves could offer a promising means of simultaneously providing clean cooking energy, saving biomass fuels, reducing indoor air pollution and reducing emission of black carbon.

Biomass gasifier-engine systems could serve to improve energy access, reduce climate impacts, and create local economic development opportunities. With India and China as the leading players, there are clear opportunities for South-South technology transfer with other regions.

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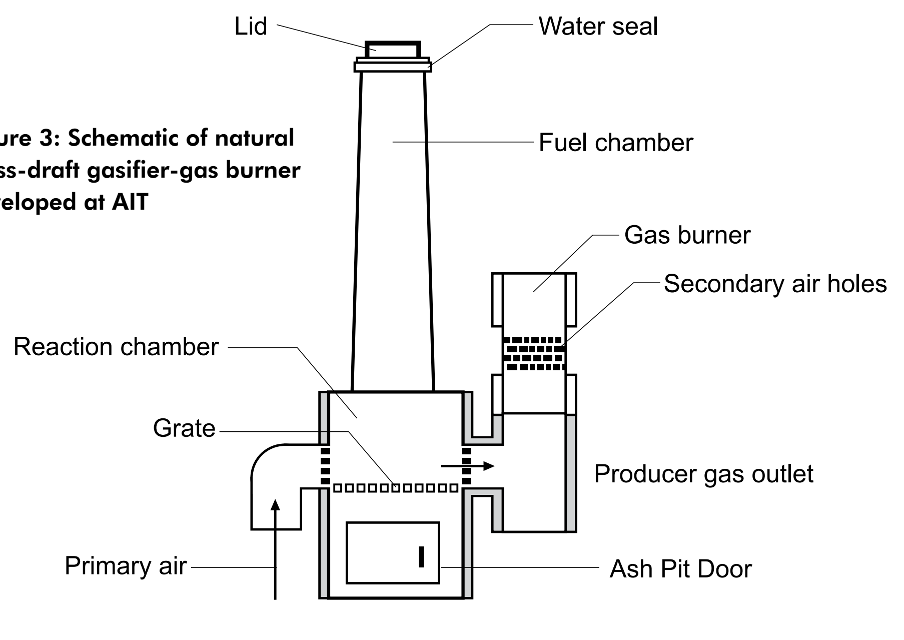

Figure 3: Schematic of natural cross-draft gasifier-gas burner developed at AIT

The expansion of soy production and trade in Latin America

Patricia Vilchis Tella, SEI

The exponential growth in world soybean production and trade in recent years is unprecedented in scale and scope compared to any other crop in the world. The overwhelmingly majority of the demand is for feed and food, but there has also been increased demand for biodiesel made from soya. This article surveys the global market, but focusing on European consumption and the challenges for sustainable production in Latin America.

Alicia Crossara (Universidad de la República)

Researchers from Science Faculty of the Universidad de la República in Uruguay study the consequences that inadequate agricultural practices and the drought that struck Uruguay in 2008 had on the soil for soybean plantations.

Soya has become an important source of protein for food and feed products and is well-established around the world. Soybeans are crushed to make soy meal and soy oil, which are the two main products in economic terms. In addition to its use as an efficient source of protein, soybeans have also become a feedstock for biodiesel as a substitute for fossil diesel, especially in North and South America. The rapid increase in global demand for imported soy products, especially in Europe, India and China, has led to increasing concerns about the land use impacts in the producing countries as well as the overall sustainability of soya in socio-economic and environmental terms.

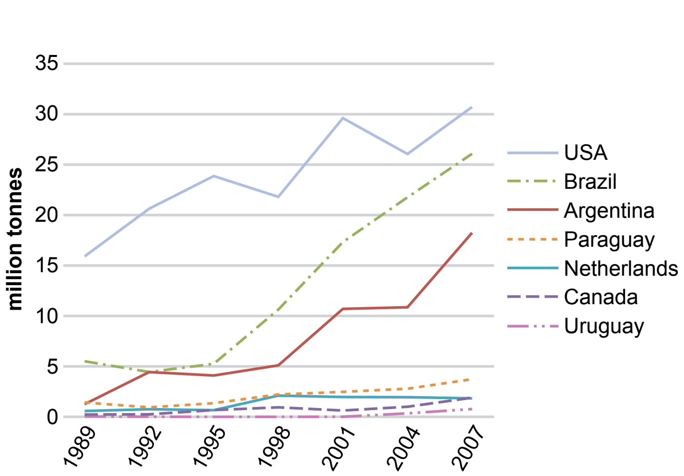

Figure 4: World top exporters – soybean complex
Source: FAOStat

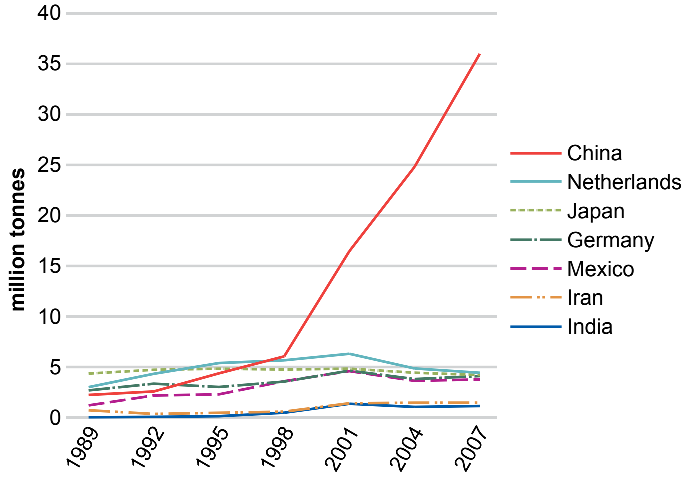

Figure 5: Top importers of soybean complex
Source: FAOStat

The global market

The dramatic growth in world soybean production is unequaled by any other crop in the world. This growth is being fueled by growing consumer demand from Asian countries like India and China and the increasing demand of feed for the meat industry in Europe. According to the Brazilian Agriculture Department, global soy consumption is set to increase by 27 percent by 2015 as compared to 2005 levels. Latin American countries, in particular Brazil and Argentina (See figure 4) are the main engines for the soy boom in Latin America.

Although China represents the destination for most of the soya exports from the MERCOSUR free trade zone countries in South America (see figure 5), the European Union has had a steady increase in consumption over time and represents the second top buyer with about 21% of total soy exports. According to a report produced by Friends of the earth (Profundo, 2008) all the soybeans imported into the EU are crushed into soy meal and soy oil. In 2007, 3.5 million tonnes of soy oil and 36 million tonnes of soy meal were available on the market to be processed further in the EU.

Land use

Soy cultivation in South America showed the most dramatic increase in harvested area during the last decade. Globally from the end of the 1990s until 2009 the total harvested hectares increased in about 35% whereas in the MERCOSUR countries (Brazil, Argentina, Paraguay and Uruguay) the total area almost doubled from roughly 22 million hectares in 1999 to 42 million in 2009 (See figure 6). Actually in 2005/6 the MERCOSUR represented almost 50% of global production of soy whereas in 1994/5 it was only about 30%.

Argentina and Brazil are the biggest producers in the region and are also leading the expansion in other countries through direct investment; in Uruguay, for example, the most important companies involved in soy production are Argentinean.

Socio economic consequences

The expansion of the soy market has had a positive impact on MERCOSUR´s nations' income from exports. In 2007, the total value of soybeans exports alone was 11,000 million USD. However, the cultivation, processing and commercialization of soy in MERCOSUR is controlled by just a few transnational companies: Grupo Maggi, in Brazil, which is owned by the magnate and governor state of Mato Grosso by the Socialist People's Party, Blairo Maggi, along with three large multinational firms Monsanto, Cargill Bunge and ADM. Within the nations of MERCOSUR, between 40 and 50% of the total capacity for soy production and processing is controlled by these companies. Small and medium companies have little space to compete locally with these giants and to be able to access the international market, they often have to go through intermediaries and brokers, which are also controlled or owned by these same transnationals.

In addition to this, more and more farmers, especially in Uruguay and Argentina, are switching from labour intensive cattle grazing and dairy/meat production to soy production, thus substituting manual labour by highly mechanized and standardized processes.

Environmental consequences

In 2008, a report developed by the Ministry of Environment and The United Nations Development Program (UNDP) identified soil degradation, desertification and water pollution as the main environmental problems caused by agriculture. There are a few studies evaluating the impact of soy cultivation in Latin American environment; the most extensive report is the "Evaluation of the impact of soy productive chain" (2008) that was commissioned by OAS (Organisation of American States).

This study identified the impacts on soil as the most worrying for Uruguayan agriculture. Soils in landscapes like those in Argentina, Uruguay and South Brazil are very fragile;most of them are very sandy and monoculture practices and cultivation of crops as soy, which leave little or no organic cover, accelerate the erosion caused by rains and the accumulation of nutrients and chemicals in water bodies (Blum, 2007).Furthermore, periods of drought were cyclic phenomena in the region, but are becoming more anomalous and strong with climate change; the degradation of soil due to extensive agriculture and forestry has made agricultural areas more vulnerable to these disturbances. At the end of 2008 and beginning of 2009 a drought hit Argentina and Uruguay with approximate losses of USD 450 million.

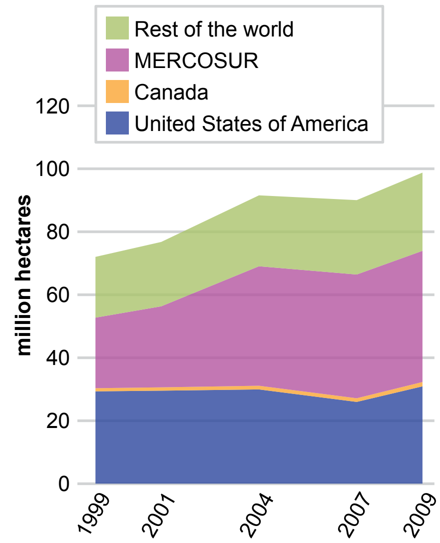

Figure 6: Soy cultivation – area harvested
Source: FaoStat

Another environmental problem related to agriculture is pest outbreaks; the excessive use of pesticides to protect monocultures from pests eliminates as well the natural enemies of these species, making outbreaks more aggressive as they develop resistance to the pesticides

After the severe drought that affected the MERCOSUR region in 2008, the governments of these nations are taking measures to prevent soil erosion and improve the sustainability of the soy industry. However, very few steps have been taken to develop sustainability criteria for producers to follow.

The Round Table on Responsible Soy (RTRS)

The Round Table on Responsible Soy (RTRS) is an international organization created in Switzerland in 2006, by a group of NGOs and private companies (WWF, Coop Switzerland among others) to develop and promote standards of sustainability for the production, processing, trading and use of soy around the world. The objective is to develop a certification scheme to guarantee that certified companies comply with a set of 5 principles for responsible production:

1. Legal compliance and good business practices
2. Responsible Labor Conditions
3. Responsible Community Relations
4. Environmental responsibility
5. Good agricultural practices

The organizational structure is balanced with representatives from three main groups:

1. Producers
2. Industry, Trade & Finance organizations
3. Civil Society Organizations

Other interested groups, such as public institutions, research organizations and individuals, are accepted as observing members but have no voting rights.

In conversations with different stakeholders of the soy chain in Latin America, the main obstacles to the implementation of RTRS criteria and certification were perceived as: (a) the lack of demand for a certified product and (b) the difficulties setting a baseline for comparison for the agro-ecological indicators of the criteria (*e.g.* soil conditions, native vegetation cover, state of surrounding water bodies, etc.) Since many international buyers are not interested in paying much more for a certified product, as the quality of the grain *per se* does not vary too much, and since the RTRS certificate involves a significant investment of money and time, it is unlikely that RTRS criteria will be attractive enough to be applied, especially for medium and small companies.

European companies that have shown interest in a certified product would only pay a marginal amount that would not compensate the investment required for such certification. The entry into force of the EU Directive on the promotion of the use of energy from renewable sources, which gives environmental sustainability guidelines for energy crops and biofuels, may persuade producers to adopt schemes like the RTRS in order to guarantee their continued access to the European market. However, the GHG emissions indicators will need to be revised in order to comply with the specifications and methods in the Directive. Furthermore, the criteria in the EU Directive only apply for soya to be used for biodiesel and NOT for that which is to be used for food or feed.

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Alicia Crossara (Universidad de la República)

Soybean processing equipment in Uruguay

Carbon finance for woodfuels: a comparison of options and approaches

Alesia Israilava and Patricia Vilchis Tella, SEI

Woodfuels represent the single largest class of renewable energy options; modern applications using woody biomass have started to attract carbon finance from various sources. This article provides a brief and selective overview of carbon finance options and illustrates some key issues by reference to examples from three different types of carbon finance.

In global terms, use of woodfuels is still dominated by traditional biomass for household cooking in the developing world. At the same time, the market for modern bioenergy in the heat and power and transport sectors has grown tremendously in recent years. Woody sources offer more uniform quality of biomass compared to agricultural sources, and are especially valued for heat and power applications where reliability is crucial. The availability of carbon finance has contributed in some cases to the bioenergy expansion, although the somewhat higher complexity and transaction costs of bioenergy projects compared to other renewables has presented some difficulties.

Woodfuels: Possibilities for Carbon Finance

With sustainable production/exploitation and efficient modern technologies, woodfuels offer an attractive option for greenhouse gas (GHG) mitigation. However, the use of woodfuels for modern bioenergy in the developing world remains small, and the question arises as to how carbon finance can play a bigger role in expanding the market. Selected types of carbon finance are briefly discussed below, followed by a summary and comparison of woodfuel projects that employ different types of carbon finance.

Various types of carbon finance have emerged over the past decade or so, including voluntary schemes and bilateral or multilateral programmes as well as the approaches and project mechanisms designed under the UNFCCC and the Kyoto Protocol. Under Kyoto, the project mechanisms—Joint Implementation (JI) and the Clean Development Mechanism (CDM)—are now well-known globally. The *Voluntary Carbon Standard* (VCS) for carbon offsets is an example of a certification system that is aimed at attracting commitments from various organisations and individuals. The Global Environment Facility was established in 1991 to support several UN conventions and engages in climate mitigation and adaptation projects.

Clean development mechanism (CDM)

The CDM allows Annex B countries with climate commitments to carry out projects in developing countries, and thus obtain certified emission reduction (CER) credits. Establishing *additionality* is critical for a project to be accepted; it must be shown that these projects would not have otherwise occurred. Any proposed CDM project has to use an approved baseline and monitoring methodology in order to be validated (CDM, 2010) or a new methodology must be proposed in case that approved methodologies are not applicable.

Asia, especially India and China, dominate CDM investments with more than 60% of the total. Latin America is second place with around 25%. The dominance of these regions was aided by stability of governmental partners, strong economic growth, and the availability of physical infrastructure and administrative structures. Furthermore, with fairly advanced industrial sectors and well-established government bureaucracies, it was easier to replicate methodologies and keep transaction costs low.

Voluntary Carbon Standard (VCS)

The VCS is a program within the voluntary carbon market for a standard approval of credible voluntary offsets. VCS offsets must be:

- real (have actually happened);
- additional (beyond business-as-usual);
- measurable and permanent (cannot just temporarily displace emissions) and
- independently verified and unique (not used more than once to offset emissions).

All the carbon offsets generated under the Program, Voluntary Carbon Units (VCUs), are registered within the VCS Registry System (VCS, 2010). The VCS Program can recognize GHG offset programs that meet VCS criteria, which include CDM and JI. The sectoral scope under the VCS is almost identical with that of the CDM and contains 15 sectors, including Energy industries, where the wood-based energy projects fall.

Global Environment Facility projects

The GEF funds a broad array of project types that vary depending on the scale of resources, project needs and the issue addressed. A project proposal has to addresses one or more of the GEF Focal Areas. GEF financing can be sought only for the agreed-on incremental costs on the measures to achieve global environmental benefits. Projects must involve the general public in decision-making and must be endorsed by the government(s) of the country/ies in which it will be implemented.

In comparison with CDM or VCS projects, GEF projects might include the enhancement of energy security by increased energy efficiency and deployment of renewable energy types, and the use of institutional capacity building and awareness-raising. The actual introduction of new facilities or upgrading of existing ones to allow for use of woody biomass would usually be a part of the whole project, with its practical part playing a demonstration role. The costs of the practical part can be used for the analysis.

CDM project at Empee Distilleries, Tamil Nadu, India

The Empee Distilleries project is based in Mukudi village in Tamil Nadu, India and is expected to have a capacity of 10 MW, with woody biomass replacing fossil fuels. Approximately 1 MW of the electricity generated will be used for internal consumption and the balance of 9 MW will be exported to the Tamil Nadu Electricity Board (TNEB) grid, which is connected to India's Southern Regional electricity grid of India (FAO, 2010).

Local producers will supply biomass to the plant. Woody biomass is presently used as domestic fuel, animal fodder, for roof-thatching, and as fuel for small industries such as brick kilns. The surplus biomass available in the area (Pudukottai District) for use as bioenergy feedstock has been estimated as 70%, and domestic users will not be required to change their biomass fuel consumption habits, given that there is ample biomass available.

Investment costs include pre-operational expenses and total capital investment for the project (USD 9.8 million). The operation and maintenance costs include fuel costs, O&M costs, administrative expenses, salaries, utilities, etc. and constitute USD 3.4 million per year on average; and finally carbon project development costs are taken as USD 0.05 million and monitoring and verification costs are included as USD 0.01 million per year. Thus, final costs are equivalent to approximately USD 13.2 million (CDM, 2010).

GEF – Woodfuels for Heating and Hot Water, Belarus

The goal was to reduce GHG emissions through switching from fossil fuels to biomass by increasing the capacity of the government to support biomass energy projects and the capacity of customers to finance and implement them. The technical component included introduction of five demonstration projects (two CHP and 3 facilities producing only heat), using forestry residues and woody waste from woodworking enterprises. The projects required upgrading of existing facilities, which previously utilised mazut oil, natural gas and electricity. The total installed heat capacity was 32.2 MW_{th} and total electricity capacity was 1.25 MW_{el}.

The relevant costs for the baseline scenario were estimated at USD 5.50 million. The costs for the project scenario were estimated at USD 7.51 million, with the costs related only to the measures on these five demonstration objects constituting USD 6.25 million. Therefore, the incremental costs due to the project were USD 2.01 million. Direct CO_2 emission reductions from the projects were estimated at 72,000 tonnes CO_2 annually or 1.08 million tonnes over the 15-year period (UNDP, 2010).

VCS – Woodfuels at Kitambar Ceramic, Brazil

The project at Kitambar, a small ceramic industry, involved fuel-switching for the energy to feed the kilns. In this case, the switch is not away from fossil fuel, but rather from "non-renewable biomass," which in this case was native wood that came from areas lacking sustainable forest

Table 1: Emissions reductions and costs under different wood-based projects

Project/ Country	Emissions under baseline scenario, million tonnes CO_2-equiv.	Baseline scenario costs, USD million	Emissions reductions under alternative scenario, million tonnes CO_2-equiv.	Alternative scenario costs, USD million	Incremental reductions, million tonnes CO_2-equiv.	Incremental costs*, USD million
CDM/India	0.37	n/a	0.18	13.20	0.19	n/a
VCS/Brazil	0.278				0.278	
GEF/Belarus	n/a	5.50	1.08	7.51	n/a	2.01

* Difference between the alternative scenario costs and baseline scenario costs

This woodfuel demonstration project in Mostodrev, Belarus was supported by the Global Environment Facility.

management. The new sustainable sources were to be Algarroba wood and cashew tree residues, accompanied by a small share of coconut husk. Among a number of projects switching from non-renewable to renewable biomass this project was chosen because wood constitutes the main part of the biomass in the scenario.

The VCS project used a CDM methodology for wood-to-wood fuel switch (AMS-I.E.): "Switch from Non-Renewable Biomass for Thermal Applications by the User" (CDM, 2010).

In the baseline scenario with use of non-renewable biomass, the annual wood consumption is 32,700 m^3, whereas for the project scenario the annual consumption of Algarroba wood and cashew tree residues is estimated at 20,568 m^3. Total emissions from the baseline scenario, are calculated similar to those of fossil fuels due to the non-renewable nature of the biomass, and over a crediting period of ten years constitute 417,800 tonnes of CO_2. Total emission reductions are equivalent to the baseline emissions in applying the methodology.

Investment costs for the baseline scenario are zero and for the project activity—renewable biomass deployment—constitute about USD 0.007 million. Meanwhile, total annual variable costs in the baseline scenario are estimated at USD 0.268 million and for the project activity 0.410 million USD. Thus, incremental costs constitute annually 0.142 million USD. The estimated annual Voluntary Carbon reduction units were 41,780.

Discussion

The three projects are summarised in Table 1. Since the different mechanisms gather data on different aspects of carbon reduction, a direct comparison is not easily made. The largest in energy and GHG terms were the demonstration projects in Belarus, whereas the largest in terms of those involved in feedstock supply is in India, due to the smaller scale of biomass production. Both investment costs and GHG savings can be measured in incremental terms, which determine what share can be attributed to carbon finance.

There are still very few wood-based projects supported through carbon finance in the Least Developed Countries. The woodfuel carbon finance options for heat and production are now fairly well-established but in the case of the traditional biomass sector, high transaction costs have presented some obstacles, although there has been progress on the methodological side in quantifying the savings from renewable biomass (VCS, 2010).

Wood fuels can offer sustainable, cost effective options for GHG emission reductions; carbon finance has thus far been aimed at medium-scale projects in large transition countries like Brazil, China and India. A greater use of different types of carbon finance could be considered in order to reach the least developed countries, rather than depending only on project mechanisms such as the CDM. In order to develop the potential in LDCs, the methodologies and institutional processes for small scale projects will need to be improved and streamlined.

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FAO (2010) "What woodfuels can do to mitigate climate change." FAO Forestry Paper 162.

UNDP (2010) GEF project document: "Biomass energy for heating and hot water supply in Belarus." http://un.by/pdf/Belarus CC Biomass ProDoc.pdf

VCS (2010) Voluntary Carbon Standard (VCS) Project Database. http://www.v-c-s.org/projects.html.

SEI-RED News

New Energy Access Project in 2010: SEI is one of four EU partners in the three-year EuropeAid project 'Energy for all 2030' led by Practical Action (UK), which aims to raise the public and political profile of energy access for achieving the Millennium Development Goals (MDGs) in Sub Saharan Africa. See: http://sei-international.org/projects?prid=1686.

New book on Food vs. Fuel: The recently released ZED books title: "Food versus Fuel: an informed introduction" addresses conflicts and synergies between production of food and biofuels. It was edited by Frank Rosillo-Calle (Imperial College London) and Francis X. Johnson (SEI) and includes contributions from agriculture, environment and energy experts from around the world. See: http://www.zedbooks.co.uk/book.asp?bookdetail=4364.

SEI at the UNFCCC meeting in Cancun: SEI staff participated in the UNFCCC meeting in Cancun, Mexico in a number of events and meetings, including a side event together with IIASA and the German Advisory Council on Global Change (WBGU) on Tuesday 7 Dec entitled: *Mutual accountability for a global low-carbon and low-emissions economy within the UNFCCC and beyond.*

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