

# Fuelwood and biodiesel – a stress test for agriculture and the environment?

The choice of renewable energies in rural areas, the environmental impacts that they have and whether they help reduce poverty depends largely on the relevant government policies. A focus on the north-east of Brazil.

Brazil’s north-east is booming: this traditionally poor region is experiencing above-average rates of investment and growth. As a result of sociopolitical income transfer programmes, above-average wage rises and rural social insurance schemes, people in the lowest income brackets are adopting the consumption patterns characteristic of affluence the world over: cars and mopeds, televisions and DVD players, cookers and refrigerators, computers, Internet access and air conditioning are the visible signs of the social mobility that is taking place. This boosts the self-confidence of the poor and provides industry with the opportunities associated with rising demand. At the same time the government’s “Light for All” programme has been bringing electricity to even the most remote parts of the country. The vast majority of rural households in the north-east are now connected to the national electricity grid (in contrast to the rural parts of the Amazon region where providing

infrastructure services is more difficult and separate “island solutions” may be more appropriate – see box on page 23). The poorest people are now playing a significant part in the rise in energy consumption – a fact which illustrates not only the economic dynamics of the present situation but also trends in social development.

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■ **What energy sources are being tapped?**

Policy-makers know that, even allowing for expected savings from greater energy efficiency, the country still needs to increase its electricity capacity by six percent per year.

A small but rapidly growing contribution to this increase is being made by wind energy. Overall, though, electricity from hydropower continues to predominate. Large-scale hydropower projects remain controversial, not only among environmentalists, but the majority of energy experts consider that in the face of the rapidly rising demand for electricity there is no viable short-term alternative. Moreover, a government that is forced to ration electricity use – as happened in 2001 – has little prospect of being re-elected.

*Small and medium-sized plaster-making businesses, together with brickworks, are among the major users of fuelwood from the Caatinga.*

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Photo: I. Melchers

Electricity is one thing. But where does the thermal energy come from for industrial processes in the rural north-east? For heating the coppers for the laundries of the rural textile industry, because more and more people are buying jeans? Or for the expanding milk-processing facilities, because even the lower income groups can now afford milk and yoghurt? Or for producing plaster and firing bricks and roof tiles for the booming construction industry?

By far the most important source of this process energy is fuelwood and charcoal from the tropical dry forest of the Caatinga (see Box). Fuelwood and charcoal are also used by rural households and bakeries. Local experts estimate that 30 percent of all the region's energy comes from the Caatinga.

### ■ Renewable energy needs renewal!

Yet more than 90 percent of the forest clearance that takes place is illegal – and environmentally damaging. And the combustion methods used are inefficient. At the same time felling, transport, charcoal processing and the use of charcoal in countless production processes creates jobs and earnings for around ten thousand people. A simple ban would therefore be counterproductive. However, one finding remains clear: it is not farming, not urbanisation and not even the use of fuelwood by private households that is degrading the soil, reducing species diversity and accelerating the effects of climate change – these problems are caused mainly by the rapidly growing energy hunger of process industries.

The Caatinga takes between ten and twenty years to recover from clearance. One option would be to introduce a coppicing system in which the entire area to be managed is divided into up to 20 lots; each year just one lot is felled and is then left untouched for up to 20

### Caatinga: a sensitive ecosystem

The Caatinga is a special type of vegetation found in this semi-arid area. Drought prevails for nine months of the year; every couple of years the region goes 18 months without rain. The typical vegetation includes drought-resistant trees and shrubs and often fodder legumes for cattle and goats. A wide variety of plants grows here, many of them forming the basis for herbal medicines.

The Caatinga covers 850,000 square kilometres – ten percent of Brazil's territory. It is home to 28 million people, or 15.5 percent of the country's population. Most of Brazil's rural poverty is concentrated in this area. Many people here still live **within** the agrarian system but no longer **from** it. Climate change is forcing major efforts at adaptation upon the Caatinga.

The forest is being felled mainly to meet the growing demand for energy. Sustainable use strategies seek to combine environmentally friendly production with more efficient combustion. In the medium to long term alternatives to fuelwood will have to be found.

*The Caatinga in the rainy season.*



Photo: I. Melchers

years until coppicing takes place again. This way of managing forests used as sources of fuel was common in Europe until the 20th century; it fell out of fashion only as the use of cheaper (fossil) fuels became more widespread. In Brazil it is a practice that is still relatively unknown and has not yet replaced simple, unregulated, cheap and illegal felling.

### ■ Sustainable wood use: a long process, ...

Under a regulated forestry system, a forestry expert draws up a forest use plan. The plan includes a detailed inventory of the tree stock and describes how the forest will be used over a period of 10 to 20 years. Professional support and advice must be provided throughout that period, and the plan must be approved by the state environmental agency. However, it is frequently the case that this agency lacks the qualified staff, resources and transport facilities needed for it to perform its support, guidance and monitoring functions. Despite this, steps have been taken

in recent years to expand, process and systematically consolidate existing knowledge. There are now 250 active use plans in the region; between them they cover 150,000 hectares of land which produce 500,000 cubic metres of fuelwood annually – enough to meet six percent of the demand.

### ■ ... and an economically promising one

This type of forest use is also commercially interesting because it enables additional income to be generated, especially during the dry period. The plans for sustainable forestry in the Caatinga enable ecological sustainability to be guaranteed. The effective demand for legal fuelwood and charcoal is likely to rise, because the market will have to make greater efforts to find clean solutions. Since 2009/10 there have also been positive changes in the political framework. This form of use is now promoted not only by the environment ministry but also by the ministry for agricultural development, which manages the budget for support of small farm-

### Biodiesel: food versus fuel?

The production of biodiesel does not in any way diminish food security in Brazil – regardless of whether the oil plants are grown by large-scale or by small-scale farmers. Quite the opposite. The income transfer programme “Bolsa-Família” boosts the demand potential of more than 12 million poor families and thus directly improves their food security – and their demand power. The increase in farmers’ incomes as a result of the contractually assured sale of their oil plants has a similar effect. An additional factor is that the Ricinus is grown with the staple foods maize and beans as part of a mixed cropping system. And even soya growing yields plant oil, which most Brazilians use daily in the kitchen because it is the cheapest edible oil and an important fuel. The economically far more important part of the soya bean, the protein cake, likewise remains in the food chain – via the stomachs of Brazilian, German or Chinese animals.

ers and for agricultural reform. Just in time, one might think, because climate change is creating additional pressure to adapt. Climate experts predict that the amount of land suitable for farming will decrease sharply over the next few decades; in the Caatinga this will necessitate a gradual shift away from farming and towards forestry.

### ■ The National Biodiesel Programme

The national government has been promoting the production of biodiesel in Brazil since 2005. In contrast to the alcohol programme initiated by Brazil’s military dictatorship in the mid-1970s, the biodiesel programme has from the start set out not only to provide the transport sector with a

new – and renewable – fuel but also to promote production by small farmers and make it easier for them to access the market. An additional aim is to diversify agricultural resource production: as a result of decades of promotion, agricultural research, large-scale mechanised production and the sales channels available, soya was initially the only crop that was able in the short term to meet the rapidly rising demand for raw materials for biodiesel production. To avoid having to rely solely on soya farms in the mid-west, the new plan was to also use a range of oil seeds from all Brazil’s different climate zones for biodiesel production. However, this is an objective that has not yet been achieved; expanding the production base to include other crops and setting up marketing structures is a long-term task.

### ■ Demand has risen, small farmers have become involved

All the other objectives of the programme have been achieved. All filling stations in the country were required by the government to blend diesel with two percent biodiesel (B2) by June 2008. By June 2009 a three-percent blend (B3) was mandatory. B4 was introduced in July 2009 and B5 on 1 January 2010. The monthly demand for biodiesel is rising steadily as a result: from around 60,000 m<sup>3</sup> for B2 to the current figure of 180,000 to 210,000 m<sup>3</sup> (B5). In August 2010 there were 63 biodiesel factories with approval from the regulator ANP to produce biodiesel; installed capacity amounted to around five billion litres per year.

It has also been possible to ensure that small-scale farmers are not excluded from the burgeoning market. This has been brought about primarily through the introduction of a social seal: biodiesel companies receive tax concessions if they can demonstrate that they use small farmers as suppliers. Despite the historic advantages of mechanised farming, around a quarter of the raw materials for biodiesel production are now produced by small farmers. More than 80 percent of the installed production capacity for biodiesel is now in the hands of companies that hold the social seal.

### ■ How do small farmers in the north-east benefit?

When the biodiesel programme was launched, the disadvantaged farmers in the semi-arid north-east of the country were trumpeted as beneficiaries. Has the reality lived up to the promise? Of the 109,000 farmers who have sup-

*Brazil’s agricultural ministry has now joined the country’s environmental ministry in promoting the sustainable use of timber in the Caatinga.*



Photo: I. Melchers

## Electricity in the Amazon region: mains connection or distributed system?

Televisions, refrigerators and fans need a reliable electricity supply; for irons, washing machines, dishwashers and air-conditioning systems this supply must be a powerful one. In rural areas, especially in remote regions, the required energy supply may simply not exist. Should potential users in such areas be connected to the national grid, or is it better to set up a distributed system? A decentralised system may be a mini-grid, which functions for households like a low-power supply grid. It may also be a “home system” supplying just one household. Both types of decentralised system require either batteries or a generator, which in most cases is the most costly item in the maintenance bill. If connection to a grid is technically feasible and financially justifiable, this solution is usually chosen. If, however, a place or a single dwelling is a long way from the grid – perhaps in the jungle, on an island or in some other inaccessible location – distributed solutions are likely to be considered.

### ■ What energy source should be used?

The choice of energy source (sun, wind, water) or fuel (diesel, petrol, biomass, bio-

fuels) depends on the local situation and on accessibility. If the task is to conserve food or operate electronic entertainment systems – i.e. power requirements are relatively low – easy-to-install solar systems may be the most appropriate way of providing energy. In remote areas diesel generators are often used, even though such systems are no cheaper overall than solar or wind systems. Of these options, a diesel generator is cheaper to acquire but far more expensive to operate, maintain and repair. Biogenic fuels are inferior to wind and solar power unless large quantities of fuel are available from a source such as a local sawmill.

### ■ Examples of combined solutions

If the consumers in a settlement are not widely dispersed, the best solution may be a mini-grid with photovoltaic systems possibly combined with wind systems and diesel generators. Supply systems of this type are currently being built and tested by the local electricity supplier CELPA in a village on the island of Araras in the state of Pará in the north of Brazil and by Eletrobras Amazonas Energia in twelve districts in the state of Amazonas. These

systems will provide each household with around 30–50 kWh of energy per month. The investment costs amount to around Brazilian reais (R\$) 30,000 (approximately EUR 13,500) per household. If the homes are widely scattered, compact “solar home systems” may be an appropriate solution. The energy supplier Eletrobras Acre has recently built and tested 104 systems of this type in the state of Acre in the north of Brazil. These systems supply each household with around 13 kWh of energy and can also be used to operate very efficient small refrigerators. The investment costs amount to around R\$ 18,000 (approximately EUR 8,100) per household. All these systems can continue to supply electricity for two days in the absence of insolation. The systems in the projects mentioned are largely maintenance-free; nevertheless, the energy supplier incurs running costs that are not covered by the income from the energy that the systems provide. However, the comparable need for subsidy would be considerably higher if diesel generators were used.

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plied the biodiesel companies in 2010, 55,000 – more than half – are small farmers in the semi-arid north-east; over the last three years their numbers have been rising rapidly. More and more holdings that have come into being through the agrarian reform programme are among the contractual suppliers of the biodiesel companies. Alongside various smaller companies the energy company Petrobras is an important purchaser of Ricinus from farmers and cooperatives. The price of Ricinus is currently too high for it to be used as biodiesel; it is therefore used for more refined processes in the chemical industry. For the small farmers, however, the crucial factor is not the end use but the effective demand and the rising prices paid to producers. Contracts are concluded directly

between Petrobras and the individual farmers or – increasingly – with farmers’ cooperatives. They must be approved by the policy representatives of a farmers’ organisation. The contracts guarantee the farmers a minimum price, seed and technical advice and hence establish medium-term prospects that provide farmers with an incentive to expand their production base and deploy technology.

### ■ Modernising the marketing relationship

Alongside the beneficial effects on income, the opportunity to sell directly and on a contractual basis to a (large) company is the crucial factor in the change that is taking place. Farmers in

the region are usually dependent on the local dealer: they have a sense of loyalty to him, they owe him money, they meet their day-to-day needs by buying goods from him, he comes along with his van and they sell him their produce. There is no alternative. In practice it is a dependency relationship, not just in economic terms. It is more or less inevitable that the farmers will make little profit when their product arrives at the processing factory by way of a string of inefficient local trading stations. The biodiesel programme in the north-east brought ten thousand farmers a different experience that is provoking change: a direct marketing relationship with a company does not entail *more* dependency, as some organisations maintain, but the opposite – *less* dependency. It gives farmers



Photo: I. Melchers

*For more than 50,000 small farmers growing Ricinus as an additional crop makes economic sense.*

source of income. In relation to both it is possible for the government, using fairly simple means, to encourage energy production on the basis of sustaina-

istic tactics in the attempt to convert malefactors into benefactors.

In both situations the private sector plays an important part as an “agent of change”: it was investment by the biodiesel companies that got the programme up and running. Businesses have accepted the social and environmental guidelines and conditions imposed by the state and are adhering to them. Dialogue at local and national level with all the relevant stakeholders ensures that information, forecasts and problems can be communicated promptly and that appropriate channels are available for handling any conflicts that arise.

Because production and use of fuelwood and charcoal is highly fragmented, medium and large companies have very little involvement with these products. As a means of raising public awareness, pressure is to be put upon influential anchor companies that use fuelwood in their production processes to use only legal fuelwood covered by sustainable use plans. Through their demand for clean energy these companies will boost the relevant sector of the market and open up an additional source of income for providers of sustainably and legally produced fuelwood. It is envisaged that private demand, public promotion and the imposition of controls – backed up by sanctions – on illegal felling will have a positive impact on the attitudes of both producers and consumers.

an opportunity to expand their production base and employ technology; it represents a larger share of the end price, more negotiating power and an effective boost to cooperative organisation – in short, modernisation of the marketing relationship in social as well as economic terms, in a way that can benefit both parties.

### ■ The state, the farmers and the private companies

The examples quoted – fuelwood and biodiesel – are renewable energy sources that are CO<sub>2</sub>-neutral and reduce fossil fuel use. Both are an intrinsic part of the rural economy of many thousands of people, who view them as an additional

ble land use and redistribution in favour of the poor.

The market for biodiesel only exists because it has been created by the government as a political move. By contrast, the market for fuelwood and charcoal has always existed. The previous lack of state intervention in this area has resulted in increasing use of fuelwood and charcoal by industry and hence in ever greater pressure to fell more trees. Practices may be irregular, but sanctions are rarely imposed. In the case of the biodiesel programme, environmental policy aspects were addressed by the state at the outset. In dealing with fuelwood and charcoal, on the other hand, the state has had to step in after the event and adopt real-

### Zusammenfassung

Staatliche Transferzahlungen und Programme wie „Licht für alle“ haben bewirkt, dass sogar traditionell sehr arme Regionen im Nordosten Brasiliens jetzt Wachstumsraten verzeichnen können. Die Folge davon ist ein steigender Energiebedarf bei Verbrauchern und Industrie. Neben der Wasserkraft ist die wichtigste Energiequelle das Feuerholz aus dem tropischen Trockenwald Caatinga. Die Regierung fördert zudem die Biodiesel-Produktion; mit ihrer Hilfe will sie die Abhängigkeit von fossilen Rohstoffen verringern und gleichzeitig neue Einkommensquellen für arme Haushalte erschließen. Dieser Beitrag

beschreibt die Auswirkungen von Wirtschaftswachstum und staatlicher Politik auf die Energieproduktion in ländlichen Gebieten und erläutert, wie Nachhaltigkeit auch angesichts eines steigenden Energiebedarfs weiterhin Priorität haben kann.

### Resumen

Las transferencias estatales de dinero en efectivo y los programas tales como “Luz para todos” han permitido que las regiones de acendrada pobreza del noreste brasileño logren incrementar sus tasas de crecimiento. Esto ha llevado a un aumento en la demanda de energía, tanto por parte de los consumidores como de los produc-

tores. Aparte de la energía hidroeléctrica, la fuente energética más importante es la leña del bosque seco tropical de Caatinga. El gobierno también viene promoviendo la producción de biodiesel, con el objetivo de reducir la dependencia frente a los combustibles fósiles y generar nuevas fuentes de ingresos para los agricultores minifundistas pobres. Este artículo describe el impacto del crecimiento económico y las políticas estatales de producción de energía en las áreas rurales, y explica cómo la sostenibilidad puede seguir siendo una prioridad incluso cuando es necesario afrontar una creciente demanda de energía.