## B. BRAZIL

*Contents*

# 1. INTRODUCTION

This chapter provides an overview of bioenergy and agricultural production in Brazil, and briefly reviews experiences in the biofuel industry since the 1970s. It outlines federal legislation and institutions governing this industry and highlights examples of interagency coordination. It then describes in further detail the regulations applicable to the bioethanol and biodiesel sectors, focusing on regulatory requirements, incentives and institutions in both fields, after which the discussion draws particular attention to the Social Fuel Seal mechanism. The last section reviews other legislation relevant for the sustainability of the biofuels programmes in Brazil, including its climate change plan, the Kyoto Protocol's Clean Development Mechanism (CDM) programme in Brazil, selected forestry legal requirements, ecological and agricultural zoning plans, environmental impact assessment regulations and new legislation applicable to land tenure in the Amazon. It also provides a brief overview of the main voluntary agreements addressing social and environmental conditions in the biofuels sector. The final section presents the conclusions of the study, identifies innovative legal options and provide some recommendations.

## 1.1 Overview of bioenergy and agricultural production in Brazil

Brazil is endowed with extensive agricultural resources and is a world leader in agricultural production. With 62 million hectares of cultivated land (out of a total 851 hectares, 400 million of which are protected areas, including the Amazon rainforest) dedicated to fruit, vegetable and cereal production, Brazil's croplands produced 135 million tons worth of agricultural products in 2008, and was the third largest global exporter of agricultural products, with exports totalling US$ 71.8 billion. In the same year, agribusiness contributed 25 percent of Brazil's gross domestic product (GDP), employed 35 percent of the labour force, and accounted for 36 percent of total exports. Brazil is the world's leading producer of coffee, sugar and orange juice, and is also a major global producer and exporter of soybeans and cotton. Two of these, sugarcane and soybeans, are Brazil's primary bioenergy crops, with sugarcane bioethanol alone representing 16.4 percent of Brazil's total domestic energy supply.

Brazil's overall energy profile is quite green, with 45.3 percent of the energy supply coming from renewable energy sources in 2008. Additionally, Brazil has been close to achieving complete energy independence for the past few years through its combination of intensive renewable energy use and

increasing petroleum production capacity. Achieving energy independence has been a long-term goal of successive Brazilian governments since the first oil embargo of the Organization of the Petroleum Exporting Countries (OPEC) and resulting oil crisis of 1973. This led directly to the creation of the first Brazilian bioethanol programme *Pró-Álcool* (*Programmea Nacional do Álcool*) in 1975, as an instrument to achieve the objective of energy independence by replacing petroleum imports with domestic transport fuel production.

Although domestic bioenergy consumption has gone through ups and downs since then, Brazil's current bioenergy programme is one of the most advanced in the world. This programme is characterized by a detailed tax exemptions regime, mandatory blending of 25 percent bioethanol with gasoline, and the most significant catalyst for current success – the introduction of flex-fuel automobiles in 2003 that can run on pure gasoline, pure bioethanol or any combination of the two. The availability of these new automobiles has galvanized domestic demand for sugarcane bioethanol, with more than 80 percent of vehicles sold in 2009 being flex-fuel. In the decade prior to the introduction of these vehicles, domestic consumption of bioethanol fluctuated between approximately 10.5 and 13.6 billion litres per year. In 2008, only five years after their placement on the market of these vehicles, domestic consumption rose to approximately 18.9 billion litres (out of a total production of 22.5 billion litres, with the remainder being exported).

A further benefit of Brazil's use of sugarcane for bioethanol production is the co-generation of electricity produced using plant residue, or bagasse, which accounts for 25–30 percent of plant weight. In most cases this process is sufficient to completely power bioethanol plants and in some cases, produces excess electricity that is sold to the national grid. Indeed, in 2008 an important part of the 4.1 percent of electricity in Brazil generated from biomass came from sugarcane bagasse.

Achieving near self-sufficiency in energy production has driven the Brazilian government to begin concentrating on other objectives for the bioenergy sector, with social and environmental sustainability goals being increasingly prioritized in recent years. The Brazilian Agroenergy Plan 2006–2011 outlines these new objectives, stating that Brazil's primary aim in this sector is to "produce and transfer knowledge and technologies that contribute to the sustainable production of energy from agriculture." The government has

created a number of specific goals in light of these new endeavours including efforts to: support movement towards a more sustainable and less greenhouse gas intensive energy matrix through bioenergy, provide increased and more equitable employment opportunities by decentralizing bioenergy production, and improve export opportunities for bioenergy products. The bioenergy plan focuses on four main products: bioethanol, biodiesel, planted energy forests (for charcoal), and residues from agriculture and forestry (including sugarcane bagasse).

Pre-empting the release of this national plan, but exemplifying its goals, is the National Programme for the Production and Use of Biodiesel's (PNPB) Social Fuel Seal (*Selo Combustível Social*) to be discussed in section 2.5.5 of this chapter. This social programme, which was initiated alongside the PNPB in 2005, provides incentives for large biodiesel producers to source from, and improve the livelihoods of, smallholders in economically sensitive regions. The primary feedstock for biodiesel in Brazil is soybean, which in June of 2009 accounted for 81 percent of Brazilian vegetable oil production. One of the PNPB's primary aims however, is to diversify biodiesel crops based on socio-ecological suitability as well as output potential. In 2008, over 1.2 billion litres of biodiesel were produced, nearly doubling the 736 000 in 2005. Additionally, with current production capacity being vastly higher than actual production, at about 3.7 billion litres, Brazil is well-positioned to continue increasing its production and consumption of biodiesel in the near future. Indeed, the drastic production increases since the PNPB's inception have seen the programme running ahead of schedule: thus, in Brazil's National Climate Change Plan of 2008, the original 5 percent blend mandated by 2013 was moved up to 2010, with the PNPB already boosting the interim blending mandate to 4 percent in July 2009.

This current stage of socially and environmentally conscious bioenergy production and consumption is seen as a positive example to which many nations currently aspire. To this end, Brazil is working bilaterally with a number of developing and developed countries through technical scientific exchanges, and promoting diversification of energy and research into improved production methods. Another initiative through a Mercosur group on biofuels created in December 2006 presents a common regional strategy towards export markets, and tariff and non-tariff barriers to trade. Furthermore, a Memorandum of Understanding with the United States was signed in order to promote greater cooperation on bioethanol and other biofuels by stimulating research and development; building domestic biofuels

industries in third countries; and working multilaterally to advance the global development of biofuels. Brazil is also a member of the Global Bioenergy Partnership sponsored by FAO and the International Biofuels Forum and has signed a host of bilateral cooperation agreements, for example with Mozambique and Sweden.

Taken together, Brazil's bioenergy policies over the years have contributed greatly to the current success of Brazilian sugarcane bioethanol production and the potential of its nascent biodiesel industry. While the government still plays an important role in this industry as detailed further in subsequent sections, Brazil runs one of the most 'hands-off' bioenergy programmes in terms of government intervention. The following discussion outlines the history of Brazil's bioethanol and biodiesel programmes, and thereafter presents the current legal and institutional framework for bioenergy in Brazil focusing on bioethanol and biodiesel legislation.

## 1.2 Creating a new market: a brief history of the National Alcohol Programme, *Pró-Álcool*

From 1975 to 2006, Brazil consumed over 275 billion litres of domestically produced bioethanol, saving over US$ 69 billion worth of foreign exchange by avoiding the purchase of oil from abroad. The history of this massive endeavour can be broken down into four phases. The first (1975–1979) was predicated on the aforementioned desire to reduce dependence on foreign sources of fossil energy as a result of a balance of payments emergency created by the oil crisis of 1973, which led oil import costs spiking from approximately US$ 500 million in 1972 to US$ 2.8 billion in 1974. Aside from reducing this vulnerability, the formation of *Pró-Álcool* had another important objective – to stabilize domestic prices and demand for sugar, an industry that had previously been dependant on highly distorted and fluctuating international markets. For this purpose, a system of government subsidies and tax incentives was created for sugarcane producers and bioethanol distilleries.

The second phase (1979–1989), considered the peak of the *Pró-Álcool* years, began as oil prices jumped again in 1979 and oil imports skyrocketed to over US$ 10 billion in that year, with Brazil becoming the most highly indebted developing nation in the world in absolute terms, by 1980. Brazil began more earnestly promoting sugarcane bioethanol production in 1979 by promoting federal support for alcohol production through the creation of

the National Alcohol Council (*Conselho Nacional do Álcool*) to provide oversight for *Pró-Álcool* and its implementing agency, the National Executive Commission for Alcohol (*Comissão Executiva Nacional do Álcool*). This new institutional structure, along with a series of new financial and tax incentives, led to the golden age for *Pró-Álcool* which by 1985, saw 96 percent of all automobiles sold in Brazil running on bioethanol, with over 4.5 million of these cars being sold by the end of the decade.

The programme used six primary mechanisms to promote bioethanol production and consumption during this time: (i) the requirement that bioethanol be priced lower than gasoline at the pump; (ii) a guaranteed even price across the nation for all bioethanol producers; (iii) tax incentives for bioethanol automobiles; (iv) loans to bioethanol producers for expanding capacity; (v) the obligation for gas stations to sell bioethanol; and (vi) the creation and maintenance of strategic bioethanol reserves. The National Petroleum Council (*Conselho Nacional de Petróleo*) was tasked with assuring bioethanol supply by establishing an adequate distribution infrastructure and fixing the price at which bioethanol was sold. These incentives were always meant to be temporary however, with high oil prices expected to ensure ever-increasing competitiveness for Brazil's bioethanol as compared to gasoline.

Oil prices fell however in 1986, and by 1989, the third deregulatory phase (1989–2000), of Brazil's modern bioethanol history had begun. The year 1989 marked the beginning of a precipitous drop in bioethanol production. Contributing factors included: rising global sugar prices, upward governmental bioethanol price adjustments compared with newly inexpensive gasoline, shifting tax incentives to promote new compact automobiles, and a lack of consumer confidence in the production of enough alcohol to continue fuelling a largely pure (hydrous) bioethanol powered fleet. Sales of the previously successful hydrous alcohol powered vehicles fell drastically and by 1996, were nearly nonexistent. In attempts to save the floundering industry, Law No. 8.723 on vehicle emission pollutants was passed in 1993, mandating that all gasoline sold must be blended with 20–25 percent (anhydrous) bioethanol. This law is still in effect and is analysed below. Furthermore, in the mid 1990s, as the Washington Consensus took hold in Latin America – a recipe for economic growth promoted by international finance institutions favouring tight budget controls, market liberalization, deregulation and privatization of national enterprises – induced a sweeping process of deregulation and privatization in

Brazil. Government control of bioethanol prices fell away along with most of the incentives that had previously promoted sugarcane bioethanol production; all subsidies were dismantled by 1997.

The fourth and current stage began in 2000. Bioethanol began to rebound as oil prices increased again around the turn of the millennium, combined with continually decreasing bioethanol prices primarily owing to efficiency gains in the newly liberalized sugar industry. The 33rd amendment to the Brazilian Constitution, passed in 2001, completed the deregulation process in the fossil fuel sector by relaxing the state's monopoly on the oil industry, and by removing the last subsidies and price controls for gasoline, diesel oil and liquid petroleum gas (LPG). As a result, the biofuels sector is currently market-oriented, with large national (and some international) firms leading developments in this field. In the present decade, consumption has spiked along with increased productivity, especially after the introduction of flex-fuel vehicles, which today make up 32 percent of the entire car and light commercial Brazilian vehicle fleet, and account for more than 80 percent of current vehicle sales only 7 years after their introduction. Today, the Brazilian government plays more of a supervisory role in this sector in comparison to its more interventionist origins. However, although more limited in its actions, the government still does play a very important role in keeping bioenergy alive in Brazil. How and why this occurs will be sketched out in the remaining sections of this chapter.

## 2. LEGAL AND INSTITUTIONAL FRAMEWORK FOR BIOENERGY IN BRAZIL

Brazil has a federal government structure comprised of 26 states and one federal district. The Constitution of 1988 as amended in 2005, reserves in Article 22 the exclusive right of the federal government to legislate on energy, international trade and transportation (unless specifically devolved through the creation of a supplementary law). Article 23 of the Constitution lists areas in which shared power is held amongst the federal government, states, the federal district, and the municipalities, namely to: protect the environment and to fight pollution in any of its forms; preserve forests, fauna and flora; promote agriculture, livestock and food supply; and fight the causes of poverty and the factors leading to substandard living conditions, and promoting the social integration of the unprivileged sectors of the population. Article 24 goes on to note however, that the power to legislate

on production and consumption, the preservation of nature and liability for damage to the environment are held concurrently by the federal government, the states and the federal district, with the role of the federal government being limited to the provision of general rules and that of the states to supplement them.

With the highly centralized role played by the federal government in commerce, energy and transport, most bioenergy policy prior to the turn of the century was considered to fall within the realm of federal responsibility. However, as bioenergy has become an ever-greater political hot-button issue of late, this has begun to change and states have become increasingly involved in the environmental regulation of bioenergy. Due to the complexity of Brazil's legal framework and regulations at the state and municipality levels, this study will be limited to federal regulations on bioenergy.

### 2.1 International agreements and initiatives relevant to bioenergy

Brazil is a party to the Convention on Biological Diversity and its Cartagena Protocol on Biosafety as well as the UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. It is also a member of the World Trade Organization (WTO) since 1995.

Brazil is an active participant in the WTO's discussions on the Doha Round of Negotiations, and has proposed that biofuels be categorized as environmental goods for integration into the list of products to be liberalized within environmental goods and services negotiations. This proposal has support from several developing countries (Chile, Colombia, Egypt and South Africa) but faces serious opposition from developed countries (European Community, United States, Japan and Australia) who argue that biofuels should be dealt with under agriculture negotiations.

Brazil also plays an important role within climate change negotiations. It has put forward the so-called 'Brazilian Proposal' to take account of cumulative historical emissions for distributing the burden of emissions reductions among developed country parties. It was one of the original proponents of the Clean Development Mechanism during the Kyoto Protocol negotiations, and actively participates in current negotiations on a post–2012 climate regime.

## 2.2 Federal laws regulating the bioenergy market

A number of important federal laws have framed and continue to frame contemporary bioenergy production and consumption in Brazil, most notably Law No. 9.478 (1997 as amended) on the National Energy Policy. The National Energy Policy Law sets out as one of its main objectives the increase of the contribution of biofuels to the national energy matrix based on economic, social and environmental considerations (art. 1).

The Brazilian Renewable Energy Incentive Programme (Proinfa) within the Ministry of Mines and Energy, also established the inclusion of 3 300 MW of energy from wind sources, biomass and small hydroelectric centrals, in equal amounts, into the national energy grid, with a long-term objective of obtaining 10 percent of electricity from these sources (Law No. 10.438 of 2002, as amended).

Specific laws and regulations addressing the production and commercialization of bioethanol and biodiesel, establishing blending requirements, providing incentives and creating sectoral institutions, will be discussed in turn, in sections 2.4 and 2.5 below.

## 2.3 Institutional framework for bioenergy

The National Energy Policy Law No. 9.478 created the National Petroleum Agency, renamed National Agency of Petroleum, Natural Gas and Biofuels in 2005 (*Agência Nacional do Petróleo, Gás Natural e Biocombustíveis* - ANP), under the Ministry of Mines and Energy (*Ministério de Minas e Energia* – hereinafter Ministry of Energy). The ANP is tasked with guaranteeing the supply of petroleum products and biofuels to the entire nation and serves as the institutional framework through which oil, natural gas and biofuels are regulated. It is responsible in particular for overseeing and authorizing activities related to production, quality control, import, export, storage, distribution, retail, marketing, and environmental conservation - essentially carrying out national biofuels (and petroleum) policy. For example, it organizes biodiesel auctions to ensure compliance with the compulsory blending requirement. It is also in charge of enforcement of the law and is empowered to impose sanctions.

The National Energy Policy Law also established a National Council for Energy Policy (*Conselho Nacional de Política Energética*) within the Ministry of

Energy. The Ministry of Energy is broadly tasked with advising and recommending policy to the President on energy security as a whole, and provide guidelines for the development of the biofuels programme (art. 2). The Council, on the other hand, is tasked with suggesting policy measures to ensure the supply of raw energy to remote or inaccessible areas, establishing guidelines for specific use and trade of (both renewable and non-renewable) energy, and planning for anticipated future energy needs. The Council was established as an interagency body, the secretariat of which is made up of, among others, the ministers of: mines and energy (who serves as the president of the Council); science and technology; planning, budget and management; finance; environment; development, industry and foreign trade; national integration; and agriculture. Interagency coordination thus takes place within this forum. Energy experts from civil society and academia chosen by the President of Brazil, as well as the minister of the Civil House of the Presidency of the Republic (position akin to a chief of cabinet), a representative of the states and the federal district, and the government's Energy Research Corporation (*Empresa de Pesquisa Energética*) also participate in the Council's meetings (Decree No. 3.520 of 2000, as amended).

Other institutions currently dealing with bioenergy include Embrapa (*Empresa Brasileira de Pesquisas Agropecuárias*), the government's agricultural research entity under the aegis of the Ministry of Agriculture, Livestock and Supply (*Ministério da Agricultura, Pecuária e Abastecimento* hereinafter referred to as Ministry of Agriculture). The latter has a decentralized agroenergy unit focused on bringing to fruition the government's new aim of using research and technology to steer the agroenergy sector towards a more environmentally friendly and economically efficient future. The Embrapa Agroenergy Unit started its work in 2007 and receives most of its funding from external sources. In the medium term, it expects to enlarge its pool of researchers (current total staff is 28 people) and to coordinate the work on bioenergy of researchers in Embrapa's 40 decentralized units. In addition, Embrapa has other research units affecting the bioenergy sector, namely Environmental Research, and Satellite Monitoring and Agricultural Technological Information. It also promotes integrated farming system technologies which are currently deployed for the recovery of degraded lands, both integrating agriculture-livestock, and agriculture-livestock-forestry activities in the states of São Paulo, Mato Grosso, Parana and Goaias.

The Ministry of Environment (*Ministério do Meio Ambiente*) has an Energy and Environment Coordination Unit and is also working on the design of ecological-economic zoning regulations for bioenergy crops (*zoneamento ecologico economico - ZEE*). ZEEs are promoted by the Ministry of Environment, and implemented by a Coordinator Commission on ZEE and a Permanent Working Group for the Implementation of ZEE (Supreme Decree *s.n.* 28 December 2001, as amended).

Also, the Ministry of Foreign Relations is collaborating together with the ministries of energy, agriculture, science and technology, and of development, industry and commerce to realize the goal stated in the Brazilian Agroenergy Plan 2006–2011 of becoming a global leader in the bioenergy sector through, for example, the bilateral agreements mentioned in section 1 above.

Finally, the Ministry of Agriculture works actively with the Ministry of Agrarian Development (*Ministério do Desenvolvimento Agrário*) in developing programmes and techniques for energy generation in remote areas, and in the promotion of small-scale agriculture for biodiesel production through the Social Fuel Seal.

Regarding funding for scientific research on biofuels, Law No. 9.478 on National Energy Policy, as amended by Law 11.921 in 2009, states that 25 percent of ANP concession royalties are to be used to support scientific research and the development of applied technologies to prevent and compensate environmental damage caused by the oil, natural gas and biofuels industries, as well as first and second generation petrochemical industry (art. 49).

### 2.4 Bioethanol legislation in Brazil

Despite the liberalization of prices in the bioenergy sector in Brazil during the 1990s and early 2000s, there is still a significant government presence in bioenergy aimed at guiding and assuring the continued existence of the bioethanol and biodiesel industries. In the Brazilian Agroenergy Plan 2006-2011 the government gives four reasons justifying its continuing intervention.

- The seasonal nature of sugarcane production coupled with year-long demand for bioenergy requires the organization and maintenance of

stocks to stabilize prices over the year and to avoid scarcity between harvests, which requires significant planning and oversight at national level.

- As bioenergy is a strategic energy product, price fluctuations caused by scarcity or gluts in the market could potentially lead to energy crises which in turn can compromise consumer trust in the product as happened in the late 1980s.

- Despite the growing popularity of biofuels and their potential international trade significance (especially in the case of the European Union as a future mass importer), to date an international market is still more or less in its infancy, with most global production being used domestically. This means that, in times of domestic scarcity, there would be little recourse for a nation dependant on biofuels to acquire them from abroad, thus broad strategic management must take place at national level.

- The sector is characterized by highly concentrated land ownership, which for social and environmental reasons necessitates state intervention.

#### 2.4.1 Bioethanol institutional framework

The institutional history of bioethanol is complex. Often it was (and sometimes still is) the case that there were partially overlapping, unclear allocations of responsibility which largely stem from the multi-sectoral nature of bioenergy, i.e. its agricultural, environmental, energy, and social components. Today however, things have become much more clear-cut as Brazil prepares itself for a leadership position in a global biofuels marketplace. There are currently two major players in the Brazilian sugarcane ethanol sector, the Ministry of Agriculture and the Ministry Energy. The Ministry of Environment also plays an important controlling role but is not as active as the other two ministries. Within the ministries of agriculture and energy, similar actors form the institutional core of Brazilian bioenergy, with one in each ministry acting as a steering committee to guide policy development and another to carry out that policy.

Other than the institutional bodies dealing with bioenergy in general, as was mentioned in the previous section, there are a number of important entities specific to the Brazilian bioethanol industry. First, there is the

Inter-ministerial Sugar and Alcohol Council (*Conselho Interministerial do Açúcar e do Álcool*), which acts as an inter-ministerial steering committee for the sector, tasked with assessing the appropriate involvement of sugarcane ethanol in the national energy mix, the economic mechanisms required to enhance the self-sufficiency of the this sector, and scientific and technological development of the sugarcane ethanol sector (Decree No. 3.546, 2000). The Interministerial Sugar and Alcohol Council can be thought of as an arm of the National Council for Energy Policy within the Ministry of Agriculture. The Minister of Agriculture, who presides over meetings, is joined by the ministers of finance, development, industry and foreign trade, and energy. This interagency board coordinates and reflects upon current policy, devises new policy, and must approve new mandatory blending ratios prior to their approval by the Executive (Decree No. 3.966, 2001, see next section).

Additionally, within the Ministry of Agriculture, the Secretariat of Agroenergy Production (*Secretaria de Produção e Agroenergia*) assists the Interministerial Sugar and Alcohol Council in bioethanol policy formation, while the Department of Sugar and Agroenergy (*Departmento do Açúcar e da Agroenergia*) coordinates, monitors and evaluates the execution of government policies relating to sugarcane and sugarcane ethanol.

The Agroenergy Plan 2006–2011 announced the creation of a consortium to guide research and development that has not yet been established. The reasons cited for this delay relate to the peculiarity of Brazilian law related to public-private-partnerships. Specifically, this consortium was to take part in the establishment of a national fund, amalgamating private and public resources, to carry out the goals of the National Agroenergy Plan. However, there is a requirement under law whereby government investment of public funds must remain entirely under governmental control. This has led to attempts by Embrapa to form a purpose-specific company that would conform to Brazilian public-private-partnerships law from which this fund could be set up.

### 2.4.2 Bioethanol blending requirements

Blending requirements for bioethanol were first set in 1931 with Decree No. 19.717 requiring a mix of 5 percent on imported gasoline, which was later transferred over to all gasoline. Since then, bioethanol blending requirements have been standard in Brazil, although the amount mandated has varied considerably over time. The most recent phase of mandated

blending has its roots in Law No. 8.723 (1993) on vehicle emission pollutants, which requires that all gasoline sold in Brazil be blended initially with 22 percent bioethanol (*álcool etílico anidro combustível*), and empowering the Executive to raise this percentage between 20 and 25 percent. Through Decree No. 3.966 of 2001 the President delegated this task to the Ministry of Agriculture, requiring prior approval of new percentages by the Interministerial Sugar and Alcohol Council. Currently, the blending requirement for bioethanol in gasoline is at 25 percent (Ministry of Agriculture *Portaria* No. 143 of 2007). There has not been much discussion about the possibility of increasing this rate further. Since almost all new automobiles being sold in Brazil are flex-fuel and ethanol prices are extremely competitive with gasoline, sugar mills are not dependant on raising the blending ratio with gasoline. Interestingly, there have been even been suggestions to abolish hydrous ethanol production (sold as a separate fuel) to be replaced by the production of anhydrous ethanol (which is that blended into gasoline).

### 2.4.3 Bioethanol incentive structure

*Pró-Álcool* originally established a number of direct incentives for the bioethanol industry. Today, however, only the tax differentials on fuels, sales tax differentials on automobiles running on bioethanol (flex fuel vehicles), and mandatory blending of bioethanol into gasoline remain.

The 33rd amendment to the Brazilian Constitution, passed in 2001, enabled the Federal Government to establish a specific tax on fuels (arts. 149 and 177). As a consequence, Law No. 10.336 of 2001 created an excise tax on the import and sale of petroleum and its derivatives, gas and its derivatives and fuel ethanol, which at present heavily favours bioethanol. This is the primary mechanism for the promotion of bioethanol in Brazil. The so-called CIDE excise tax (*Contribuição de Intervenção do Domínio Econômico*) was established to finance: subsidies for the price or transport of bioethanol, natural gas and its derivatives and petroleum derivatives; environmental projects related to the gas and petroleum industries, and transport infrastructure programmes (Law No. 10.336, 2001 as amended, art. 1). Furthermore, Law No. 10.453 (2002) stipulates that a percentage of the proceeds from this tax will be applied, *inter alia*, to equalize production costs of raw materials, purchase and sell bioethanol, and finance bioethanol storage in the form of reserves.

The CIDE tax raises billions of Brazilian reals per year, and is heavily biased in favour of the import and commercialization of bioethanol as opposed to petroleum products. Law No. 10.336 of 2001 has had successive amendments, the latest of which being Decree No. 6.875 of June 2009 establishing a tax for gasoline of the equivalent of US$ 122 per $m^3$ and lowering to zero the tax for bioethanol. Biodiesel is not subject to this tax.

Flex-fuel vehicles receive a sales tax differential, reduced in 2009 on account of the international economic crisis and currently being incrementally returned to its previous level. Currently, the differential gives buyers of flex fuel vehicles a tax reduction of up to 7 percent for vehicles over 2000cc; and 1 percent for those between 1000–2000cc (Decree No. 6.890 of 2009).

Other incentives exist in the form of research and development promotion by the government. Despite the agricultural research initiatives of Embrapa at federal level, most research activity in the bioenergy sector to date has taken place with state-level funding, particularly in São Paulo where 70 percent of sugarcane bioethanol production occurs.

### 2.5 Biodiesel legislation

It has been widely recognized that the economic and energy security successes of Brazil's sugarcane ethanol production have come at high social and environmental costs. The Brazilian Government's own Agroenergy Plan indeed states that many trends within the sugarcane production chain have encouraged "increased concentration of land ownership and the prevalence of monocultures, which have ruinous socio-economic and environmental effects." With these effects in mind, when planning the government-led push for the creation of a substantial biodiesel market in Brazil, policy makers explicitly aimed to avoid a repetition of the social problems encountered with bioethanol. As a result, the Programme for the Production and Use of Biodiesel (PNPB) came to life in 2005 with the dual goals of increasing domestic production and consumption of biodiesel while, simultaneously decreasing socio-economic inequality within and between regions.

The national Programme for the Production and Use of Biodiesel created by Law No. 11.097 (2005) promotes the introduction of biofuels in the Brazilian energy matrix, establishes a minimum blending requirement and reduces taxes on biodiesel production.

Biodiesel in Brazil is mainly produced from soybeans, which accounted for 81 percent of all Brazilian vegetable oil in June of 2009, farmed traditionally in the south and centre-west regions of Brazil. Although soy is on the lower end of the scale as regards yield potential for oil producing crops in Brazil (the most efficient is the African Palm or coconut), owing to the massive pre-existing soy capacity in Brazil it remains the primary feedstock for biodiesel. Palm, by far the most efficient option available, is expected to overtake soy in the future once new plantations have grown to maturity. When this happens, it will also potentially alter the feedstock distribution in Brazil; palm does not flourish everywhere and is grown best in the tropical North, while soy grows best in the Central West and South regions. This is one of the reasons why PNPB was designed with a strong regional component, aiming at creating a multi-feedstock biodiesel supply that utilizes a decentralized production network – in contrast to the bioethanol market, where nearly all sugarcane is first brought to São Paulo for processing before it is redistributed across the nation as ethanol. To date however, this diversification has yet to truly take off, with other types of crops providing only 3 percent of the national biodiesel feedstock, while animal residues provide the remaining 16 percent in June of 2009 (ANP 2009b). It is expected that the development of alternative crops like jatropha and palm will take around 6–7 years to reach the commercialization stage.

### 2.5.1 Creating a new market for biodiesel

After *Pró-Álcool* was well underway in the early 1980s, the Brazilian government initiated two short-lived programmes supporting biodiesel, the National Programme for the Production of Vegetable Oils for Energy Purposes (*Plano de Produção de Óleos Vegetais para Fins Energéticos – Pro-Óleo*) in 1980 and the National Programme for Alternative Renewable Energy of Vegetable Origin (*Programmea Nacional de Óleos Vegetais*) in 1983. By 1986, however, primarily due to falling oil prices coupled with increasing vegetable oil prices, both plans were abandoned.

It was only again near the turn of the century that discussion of a biodiesel programme began once again, and in 2002 the Ministry of Science and Technology (*Ministério da Ciência e Tecnologia*) created the Pro-Biodiesel Research Network to begin assessing the technical, socio-economic and environmental feasibility of increased biodiesel use in Brazil (MCT *Portaria* No. 702, 2002). The PNPB was then launched in 2005.

### 2.5.2 Institutional framework for biodiesel

Prior to the creation of the Programme for the Production and Use of Biodiesel, a presidential decree created two instrumental institutional organs, playing similar roles to the policy development and implementation bodies seen in Brazil's bioethanol programme: the Executive Interministerial Commission on Biodiesel (*Comissão Executiva Interministerial de Biodiesel*) and the Managerial Biodiesel Group (*Grupo Gestor de Biodiesel*) (Supreme Decree *s.n.,* 23 December 2003).

The Commission is responsible for policy development. It is placed within the Civil House of the Presidency of the Republic and is made up of representatives from 13 other ministries who participate in making proposals for bioenergy policy and legislation. The Managerial Biodiesel Group also comprises representatives from 13 ministries but in this case is administered by the Ministry of Energy, and functions as the implementation arm of Brazilian biodiesel policy. Both institutions are considered to be effective in allowing a wide range of views to be heard prior to decision-making, and facilitate implementation of activities with a relatively low level of conflict.

In spite of the well-functioning institutional set up that enables coordinated policy-making, many environmental groups and trade unions heavily criticize the form and content of bioenergy programmes in the country.

### 2.5.3 Blending requirements for biodiesel

Law No. 11.097 of 2005 introduced a mandatory blend of 5 percent biodiesel into the domestic diesel fuel supply market to commence in 2013 and called for a 2 percent blend by 2008 as an interim measure (art. 2). The law allows the National Council for Energy Policy to amend the mandatory percentage over time. As was noted in section 1 above, Brazil's National Climate Change Plan of 2008 moved the deadline for biodiesel blended at 5 percent (B5) to January 2010 following the availability of sufficient installed capacity to supply the domestic market. The likelihood of achieving this target is considered to be quite high, with interim blending as of July 2009 already at 4 percent (CNPE Resolution No. 2, 27 April 2009).

### 2.5.4 Biodiesel incentive structure

The incentive structure for biodiesel is based on a reduction of sales and social security tax rates (PIS/PASEP and COFINS), their exclusion from the CIDE excise tax, together with a series of specific benefits for purchasing biodiesel feedstock from family and small-scale agricultural producers, through the Social Fuel Seal scheme (further elaborated in the next section).

Law No. 11.116 (2005) reduced tax percentages for biodiesel import and production and delegated power to the Executive to further alter the sales and social security tax rates. The law provides a quite complex system whereby biodiesel producers may choose between a percentage of sales tax rate or a fixed tax amount per cubic metre. In addition, the law enables the government to reduce the fixed amount per cubic metre for biodiesel production derived from supplies by family agriculture producers or rural communities, as identified by the National Programme for the Strengthening of Family Agriculture (Pronaf). The law further establishes that criteria for the government to establish tax reductions could be based on: raw materials used in production, the status of the producer or seller and the regional origin of raw materials (art. 5). Decree No. 5.297 (2004) and its subsequent amendments (the latest in Decree No. 6.606, 2008) set out to put these proposals in operation by establishing the rates for biodiesel produced with input from family farmers. Federal taxes are reduced to zero for biodiesel produced from family farmers in the North, Northeast and semi-arid areas. Additionally, it is clear that diversification of the biodiesel inputs is another of the government objectives, with expectations for castor bean or palm to increase have an increased share of the biodiesel supply matrix.

### 2.5.5 Promotion of small-scale agriculture for biodiesel: the Social Fuel Seal (*Selo Combustível Social*)

Small-scale agriculture is promoted through the tax benefits (outlined in the foregoing section) awarded to biodiesel producers purchasing raw materials from family farmers and consolidated by the Social Fuel Seal scheme created by Decree No. 5.297 of 2004. This seal is unique in the world and serves as the only fully functioning certification system for biofuels at the time of writing. It is managed by, and run through, the Ministry of Agrarian Development and ties tax incentives, federal credit and government-led procurement of biodiesel to the satisfaction of requirements that promote

regional socio-economic development by requiring the integration of smallholders into the biodiesel production chain.

The Social Fuel Seal allows biodiesel producers who source a percentage of their input from feedstock produced by smallholders to receive certain fiscal incentives and to sell their biodiesel in national auctions to satisfy the regulatory blending requirement (CNPE Resolution No. 3, 2005).

*Requirements to obtain the Social Fuel Seal*

In order to acquire the Social Fuel Seal, producers are required to fulfil three primary obligations which shall be further discussed below. These requirements are to: (i) source a portion of their overall feedstock from smallholders, with the exact percentage required dependant upon the producer's regional location; (ii) negotiate and sign contracts with the family farmers providing their feedstock or an organization representing them; and (iii) include in the contracts the price and provision of technical assistance to the families.

The proportion of feedstock that must be sourced from smallholders varies depending on the location of production, with higher proportions being required in more socio-economically disadvantaged regions. Until February 2009, biodiesel producers in the Northeast and semi-arid areas had to source a minimum of 50 percent of their feedstock from smallholders, those in the Southeast and South regions 30 percent minimum and those from the North and Central West regions requiring only 10 percent to get the Seal (Ministry of Agrarian Development Normative Instructions No's. 1 and 2, 2005).

As of 25 March 2009, however, percentages for north-eastern producers were lowered from 50 to 30 percent causing concerns that the social benefits from the seal may become diluted and generating criticism over the concentration of 80 percent of the region's biodiesel production in a single company. In contrast, beginning in the growing season of 2010–2011, the required percentage in the North and Center-West will be increased from 10 to 15 percent as a result of Ministry of Agrarian Development Normative Instruction No. 1, 2009. Changes in percentages result from a regular review of the programme by the Executive Interministerial Commission on Biodiesel and the Managerial Biodiesel Group, which in turn consults and get feedback from stakeholders. For example, industry, unions and farmers

groups were all presented with draft proposals of both the normative instructions for comment and discussion, which led to revisions that were incorporated into the final documents.

The changes in percentages have raised questions as to the motivation behind such changes and the impact on the social objectives of the Seal. The reduction in family farming percentages allocated to the Northeast was justified on the basis of the inability of small-holder farmers to keep pace with the rapidly growing production capacity in that region that was a result of the attractive tax benefits coupled with the requirements of higher mandatory blends. The reduction enacted in 2009 to family sourcing in the Northeast is thus said to have been necessary to allow processing plants to continue legal operation.

Other explanations were that the change was to remedy an over-emphasis on family-based agriculture in the Northeast in the original plan and an under-emphasis on family-based agriculture in the Central West (where 45 percent of soybean comes from). This would make way for a move towards a homogeneous 30 percent requirement across all regions which would ultimately create more opportunities for family agricultural producers in the Central West areas were most of the soybean is cultivated. According to the ANP's website in July 2009, of the 65 biodiesel processing plants in Brazil, 7 are located in the Northeast region, 23 in the Southeast and South, and the other 35 in the Central West region. Concerns remain however, that this shift may run counter to the original 'social' intent of the seal, which was precisely to promote family agriculture in the poorest and most disadvantaged regions, not those with the highest rates of production.

The second requirement for receipt of the Seal is aimed at formalizing the relationship between family agricultural producers and biodiesel companies, and enables greater monitoring of compliance with the Social Fuel Seal scheme. It thus requires that producers negotiate and sign contracts with the family farmers who, importantly, are required to be represented and assisted by of one of three currently accredited rural workers trade unions (Ministry of Agrarian Development Normative Instruction 1, art. 7 2009). Since it would not be feasible to bring corporations in direct contact with smallholders on an individual basis (as there are over 4.2 million family farms in Brazil), normally it is the case that large-scale fuel processing corporations and rural workers' trade unions draw up contracts to be then distributed to and signed by families. This requirement seeks to create cooperation that

would not likely have been possible without government intervention, and use government incentives to bring traditionally competing interests together for the benefit of both large producers and small, family farmers.

The third, associated requirement is that these contracts must include: conditions and the deadline for feedstock delivery, the price to be paid to the smallholder, and significantly an agreement to provide technical assistance to the farmers. In order to comply with the latter requirement, biodiesel producers are allowed to discount the price of such assistance from the amounts subject to federal taxation. Normative Instruction 1 of 2009 recommends four guiding principles for the focus of this assistance, namely: food security and sovereignty, sustainable production systems, generation of income, and reducing rural poverty. The Normative Instruction goes on to further describe criteria and procedures to maintain the Seal. There are some concerns, however, that as contracts are not made publicly available, that families may not profit as much as they could be from the programme. In particular, when cooperatives or unions are non-existent in the producing area or are unavailable to assist in the contract formation, the intermediaries used in their stead have often been contested for being unrelated to the workers' movement or unqualified to assist in such matters.

Overall, under the Social Fuel Seal scheme, the number of beneficiaries among family farmers is reported to range between 75 000 to 90 000 families in 2008, and is expected to reach 110 000 in 2009.

It should be finally noted that the requirements of the Social Fuel Seal scheme do not evaluate compliance with labour laws or with environmental regulations. Its impact in promoting sustainability could thus be enhanced by incorporating additional social and environmental requirements therein.

*Government-led procurement of biodiesel from Social Fuel Seal producers*

Biodiesel auctions are organized by the government to ensure compliance with the regulatory percentage of biodiesel blends. Biodiesel producers present tenders with several offers and those at best prices are purchased by private companies according to their market share. Petrobras, the state oil company, is responsible for 93.33 percent of the market.

Requirements for each biodiesel auction are set out in each call for auction and are based on Law 11.116 (2005). Biodiesel producers are required to

comply with biodiesel quality regulations and must be authorized to sell by the ANP. The ANP authorization for biodiesel plants is based upon rules stipulated by the Ministry of Finance (*Secretaria de Receita Federal*), which among other things requires a minimum amount of capital of 500 000 Brazilian reals (approximately US$ 272 000; *Secretaria de Receita* Federal Normative Instruction No. 516 of 2005). As noted by Garcez *et. al.* (2009), such requirements prevent the participation of smaller firms in the market, limiting their role to that of farming only.

The current 65 authorized producers supply the domestic market through public auctions that take place every trimester and are administered by the ANP. Of these 65 ANP-certified plants: 31 were listed by the Ministry of Agrarian Development as holders of the Social Fuel Seal in April 2009, with the other 34 apparently having fulfilled the requirements of the Ministry of Agrarian Development but which have not yet received the Seal. The auctions not only set the price for biodiesel and ensure the supply of biodiesel necessary to meet the regulatory requirements, but seek to promote social goals, by reserving a large percentage of the biodiesel market to those firms counting with the Social Fuel Seal. At the 14th auction that took place on 29 May 2009, 80 percent of the market was reserved to producers with the Social Fuel Seal with 91 percent of total production capacity belonging to distilleries that are in possession of the Social Fuel Seal. Currently, with the 4 percent blending requirement, domestic consumption is at about 1.8 billion litres per year. From the 460 million litres purchased in the 14th auction (before the 4 percent requirement came into effect in July 2009), 368 million litres were purchased from firms with the Social Fuel Seal.

### 2.6 Environmental and agricultural legislation with impact on biofuels

The legal framework for bioenergy is influenced by laws dealing with the environment, labour, land planning and food security. Although for present purposes a complete review of these is beyond the scope of this study, some of the most relevant policies and laws with the potential to affect the biofuels industry will be identified in this section, including: the National Climate Change Plan and the national framework regarding the presentation of projects to the UNFCCC Clean Development Mechanism; agricultural and ecological zoning laws determining or limiting land uses; and the Forestry Code. A brief overview of a current debate in Brazil over the formal legal recognition of customary and other types of land rights in the Amazon, and

examples of voluntary agreements to promote the social and environmental sustainability of biofuels are also presented.

### 2.6.1 National Climate Change Plan

Brazil designed its National Climate Change Plan, which contains several targets related to bioenergy, in 2008. In particular, in line with its Agroenergy Plan 2006–2011, the third objective of the climate change strategy is to "encourage the sustainable increase of the share of biofuels in the national transport matrix and also to work towards the structuring of an international market for sustainable biofuels." To this end the Plan proposes, *inter alia*, to encourage industry to achieve an average annual increase in the consumption of bioethanol in the Brazilian transport sector of 11 percent. Additionally, the 5 percent blending requirement for biodiesel is expected to result in an increase of consumption levels of more than 60 percent of biodiesel's current share of the Brazilian overall transport fuel matrix.

Regarding the sustainability of sugarcane production, bioethanol from crops raised in areas identified as appropriate for sugarcane cultivation according to ecological-economic zoning regulations (see section 2.6.4 below), is expected to avoid the emission of 508 million tonnes of carbon dioxide during the decade 2008–2017, which would otherwise be released if fossil fuels were burned instead of sugarcane ethanol. The Plan also proposes the gradual elimination of burning to clear sugarcane fields in areas where harvesting mechanization can take place. In this regard, prior legislation already required that areas larger than 150 hectares that can be mechanized (on land with an incline of less than 12 percent), should use harvesting mechanization, increasing in increments of 25 percent of each agro-industrial unit every five years (which means that at least 50 percent of all these units should be mechanized at the time of writing according to Decree No. 2.661, 1998, art. 16). The Plan notes the need to conclude agreements with the productive sector, cooperate with states where sugarcane field burning still occurs as well as the implement a monitoring system. Importantly, São Paulo state, where the vast majority of Brazil's sugarcane is grown, has partnered with the National Sugarcane Industry Union (UNICA) to end the practice of sugarcane field burning by 2014 in most areas where mechanization may take place. This state has passed a law to completely eliminate this practice by 2021. Additionally, in order to counteract the jobs which will be lost through the increasing mechanization of this sector, the agreement with the

sugarcane industry includes a commitment by the private sector to re-train 7 000 cane field workers per year.

Objective 5, to "eliminate the net loss of forest coverage in Brazil by 2015" is also relevant for the sustainability of biofuel production. The Plan sets out a series of limitations on deforestation and aims to reduce illegal deforestation rates in Brazil, explicitly noting that the development of planted forests for the production of fuel may reduce pressures on native forests. Specifically, the Plan states that promoting forest plantations with the objective of producing sustainable charcoal will reduce pressures on native forests from which a substantive percentage of charcoal is still supplied for the iron and steel industries. The Plan also sets out an Energy Forests Programme, coordinated by the forests unit of Embrapa, which among other issues will consider the production and use of sustainable charcoal to replace coal in iron and steel production facilities, mainly through the promotion of forestry in degraded areas. EMBRAPA's agroenergy unit is also planning work on evaluating the life-cycle energy balances and greenhouse gas balances of agroenergy crops, although research has not yet begun on these matters.

Brazil's National Climate Change Plan was originally mandated by Presidential Decree No. 3.515 (2000). An Inter-ministerial Committee on Climate Change was created by Decree No. 6.263 (2007) and tasked with the design of a national policy on climate change and a national climate change plan. This Committee is coordinated by the Civil House of the Presidency of the Republic, and consists of seventeen federal bodies. Besides ministerial representatives, the Brazilian Forum on Climate Change (***Fórum Brasileiro de Mudanças Climáticas*** - FBMC) is also allowed to participate in meetings of the Interministerial Committee. The FBMC is a multi-stakeholder advisory forum chaired by the President of Brazil that includes 12 ministers, the director of the National Water Agency (*Agência Nacional de Águas*) and civil society representatives or individuals with recognized expertise in this field designated by the President of Brazil (Decree of 28 August 2000). The FBMC website includes as participants in the Forum: 6 representatives of state-owned companies, 22 representatives of research institutions, 7 private sector representatives, 12 NGO representatives and 2 journalists.

Responsibility for the implementation, monitoring and evaluation of the National Plan on Climate Change is assigned to the Executive Group on Climate Change (*Grupo Executivo sobre Mudança do Clima*) that is coordinated

by the Ministry of the Environment. The National Climate Change Plan, aside from being adopted within multi-stakeholder fora, was also subject to public consultations as required by Decree No. 6.263/2007. These featured presentations, for example, at the 3rd National Conference on the Environment and meetings of the Brazilian Climate Change Forum.

### 2.6.2 National framework for the Clean Development Mechanism

The implementation of the Kyoto Protocol's Clean Development Mechanism (CDM) is relevant for the future development of bioenergy projects in Brazil. Even though at present, the failure to adopt methodologies on biofuels within the international climate change regime has meant that biodiesel and bioethanol production projects are not yet recognized within this mechanism, several other bioenergy-based projects have been presented and are already earning certified emission reduction credits.

In fact, Brazil is the third largest contributor to emission reduction credits within the CDM at 6.71 percent, following China (58.81 percent) and India (11.63 percent). There are 160 CDM projects registered in Brazil, with average annual reductions amounting to 20.7 million tonnes of carbon-dioxide equivalent. It is worth noting that unlike classic CDM projects where a foreign partner invests in new technologies in exchange for the emission reduction credits generated by the project, 65 percent of Brazilian CDM projects are unilateral, which means that projects are financed domestically and do not have a foreign partner to which credits would accrue. They thus allow Brazilian firms to sell their carbon credits at their highest value – when emission reductions are already certified.

The CDM in Brazil is managed by the Inter-ministerial Commission on Global Climate Change (*Comissão Interministerial de Mudança Global do Clima*), which acts as Brazil's Designated National Authority in charge of approving CDM projects and confirming that they indeed contribute to sustainable development. The Commission is chaired by the Ministry of Science and Technology and is comprised by representatives of the ministries of: energy; transport; development, industry and international trade; planning, budget and management; agriculture; external relations; cities; treasury; environment (holding the vice-presidency of the Commission), as well as a representative of the Civil House of the Presidency of the Republic. The Interministerial Commission issues regulations defining the requirements for presentation of

CDM projects and guidelines for the presentation of projects, including requirements for the consultation of stakeholders, which are all available online.

A look at Brazil's CDM database of approved projects provides an overview of the type of bioenergy projects in Brazil. Of a total of 211 projects it shows 44 projects which substitute fossil fuels with biomass for the generation of energy (most using sugarcane bagasse, several using residues from agriculture and forestry, and one using animal tallow). Methane capture in swine farms is present in 38 projects and biogas generation from methane in landfills in 27. Methane capture projects, however, are in most cases not yet generating electricity.

### 2.6.3 Forest Code

The Forest Code (*Codigo Florestal*) is relevant to the development of bioenergy-related activities because it is this law which determines the percentage of forest areas that may be used for productive activities and sets out limitations on deforestation for agricultural and charcoal production (Law No. 4.771, 1965 last revised in 2006). It is thus a key determinant of the sustainability of biofuel production.

For example, the Forest Code establishes Permanent Preservation Areas to protect riparian vegetation (art. 2), requiring vegetation to remain untouched when it is found on: riversides from 30 to 500 metres depending on the size of the river; water sources for at least 50 metres; on slopes steeper than 45 degrees; and hilltops over the height of 1800 metres. Any deforestation in these areas requires federal authorization following requirements set out in article 4 of the Code, including for example, a positive assessment by the state environmental agency. In addition, authorities may determine other permanent preservation areas, for example to prevent erosion (art. 3).

The Forest Code allows the extraction of wood in planted forests for fuel or for the production of charcoal, except in permanent preservation areas (art. 12). It also determines that, in the absence of other specific regulations, forests may be cut with the caveat that a percentage must be left standing as a "legal reserve", i.e. an area where only sustainable activities may be performed. The percentage of forests that must be maintained as legal reserves is: 80 percent in rural forest properties within the Amazon states; 35 percent on rural savannah (*cerrado*) properties within the Amazon states;

20 percent on rural forest, native vegetation properties in other regions; and 20 percent in rural properties on general farming areas in any region of the country (art. 16). These percentages, however, may be altered with the adoption of ecological-economic zoning legislation at the state or federal level as, for example, when legal reserves were reduced from 80 to 50 percent in the states of Rondonia and Acre in 2008 based on a recommendation by the National Commission on Environment (Decrees No. 5.875 of 2006 and No. 6.469 of 2008).

The Brazilian National Congress is presently evaluating a draft law on payments for ecosystem services (project 5487/2009), which would provide monetary benefits to those farmers who comply with laws protecting legal reserves and permanent preservation areas. Congress held public consultations on this law in 2009.

#### 2.6.4 Ecological and agricultural zoning strategies

A key set of regulations influencing the production of biofuels in Brazil are ecological-economic zoning regulations (*Zoneamento Ecológico-Econômico* - ZEE). Criteria for the establishment of these are set out by Decree No. 4.297 (2002, as amended) to Brazil's Environmental Policy Law No. 6.938 (1981). This territorial planning instrument is portrayed as one of the primary tools for ensuring the sustainability of biofuel production in Brazil. ZEEs are promoted by the Ministry of Environment's Secretary of Sustainable Rural Development and implemented by the Coordinator Commission on ZEE and the Permanent Working Group for the Implementation of ZEE (Supreme Decree of 28 December 2001, as amended).

The main mechanism for the implementation of these zoning strategies is the tying of governmental agricultural subsidies and credits to ZEEs (Programme ZEE Brazil 2 009). Prior examples of tying insurance and credit schemes to climatic risk zoning by Embrapa have reportedly been successful in saving millions of dollars in avoided losses that would have resulted from growing crops in areas subject to negative climatic or hydrological conditions. In the case of ecological-economic zoning for bioenergy crops, it has yet to be defined how the ZEE will be linked with other existing agricultural zoning strategies (like those based on climatic and hydrological conditions), as well as strategic environmental assessments and environmental licenses.

Pending the adoption of wider-ranging ZEEs, zoning is a legal tool that is already used for the cultivation of sugarcane in Brazil. For example, in 2009 the Ministry of Agriculture adopted Ministerial Resolution (*Portaria*) 54 establishing agricultural zoning for sugar cane in the State of Rio Grande do Sul for the period 2008–2009. The Resolution uses a map of climate risks, considering: quality of soil, hydrological traits, productivity, and technology as the criteria to establish which municipalities are suitable for the cultivation of sugarcane. Furthermore, the Resolution specifies that, notwithstanding the general capacity for cultivation of this crop, those areas that conflict with the production of grain are left out, thus incorporating a food security criterion as one of the limiting factors in the production of bioethanol. This strategy enables producers within permitted areas to access federal credit and insurance, and is expected to be expanded and implemented nationally.

In fact, national ZEE planning for sugarcane is expected to identify some 25 million hectares suitable for this crop, leaving out sensitive areas such as the Amazon rainforest and Pantanal. Concerns over the sustainability of dedicating such a large area to one crop (considering that sugarcane currently occupies approximately 8.9 million hectares) are assuaged by experts who do not actually expect an area of that size to be actually planted with sugarcane. Rather, setting aside this area is considered to prevent the expansion of the agricultural frontier into sensitive areas while the industry develops towards second generation biofuels with improved yields and towards the use of bagasse and straw for liquid biofuels production. It is thus clear that ZEE, along with mechanization requirements, is considered one of the strongest instruments available for the government to promote the sustainability of sugarcane. The zoning criteria reportedly will incorporate the general criteria applicable to agricultural zoning along with cropland limitations based upon political aims to preserve: primary vegetation, sensitive ecosystems (mainly the Amazon rainforest and Pantanal), Indian Reserves, conservation areas (national and state parks) and areas considered strategic for food security (mainly soybean, corn, cotton, bean and rice).

Some criticism is, however, starting to emerge in relation to the delay in adopting the sugarcane ZEE, partly as a result of protracted debates over areas that would be left out of the zoning (namely Cerrado, Pantanal and Amazon) and perhaps also as a result of pressure exerted to change the zoning away from that originally envisaged. Thus, the effectiveness of the instrument will eventually hinge upon which areas are left out and the

compliance or monitoring mechanisms included in the law as well as the degree of political consensus with those states left out of the zoning.

### 2.6.5 Environmental impact assessment legislation

Regarding environmental impact assessments, Brazil follows criteria set out in Resolution No. 1 (1986) as amended of the National Commission on Environment (CONAMA), which defines activities that require environmental impact assessment. Among activities relevant to the bioenergy industry are: power plants over 10 MW regardless of their source of fuel; agro-industrial complexes and units, including alcohol distilleries; any activity using charcoal or similar products in quantities exceeding 10 tonnes per day; and agricultural projects exceeding 1 000 hectares (art. 2).

More specifically, environmental impact assessments must respect state or municipal regulations as appropriate, and must include at least: an environmental diagnosis of the area affected by the project; an analysis of impacts of the project and its alternatives; identification of mitigation actions; and a monitoring programme of positive and negative impacts (art. 6).

A summary of the impact assessment is also required together with alternative options for the justification of the project's compatibility with sectoral and governmental programmes (art. 9). All summaries of impact assessments are to be made available to the public, and entities with jurisdiction over the studies (Ministry of Environment and state or municipal agencies, where appropriate) have the option to call for public audiences to receive comments thereon (art. 11).

### 2.6.6 Amazon tenure legislation

A heated debate has taken place regarding the formal recognition of tenure rights in the Amazon. The law under scrutiny is Law No. 11.952 (2009), based on provisional measure 458, which grants tenure rights to individuals occupying land in the Amazon states. This law was intended as a remedial measure for the land disputes that followed the government incentives (introduced as far back as the 1970s) for the occupation of public land. Conflicts arose where some settlers occupied land traditionally belonging to local and indigenous groups. The 2009 law thus restricts this process to Brazilian citizens who are not owners of another rural estate in the country

and who effectively possessed the area prior to 1 December 2004 (art. 5). In rural areas, the occupants are also required to be engaged in agriculture. It explicitly excludes from this procedure, referred to as "regularization", *inter alia*, lands that have been traditionally occupied by indigenous peoples or that are nature reserves. The law leaves communal lands to be dealt with in accordance with specialised legislation.

It should be noted that the President vetoed the proposed article 7, which would have allowed the regularization of land occupied by legal entities or by individuals through third parties. However, questions remain on the possibility for individuals to obtain tenure rights based on their self-declaration, rather than pursuant to an inspection by authorities. In addition, it is unclear why the law discriminates against smallholders, who must hold on to the land for at least 10 years whereas larger estate owners who are allowed to sell these properties after 3 years (art. 15).

Criticisms of this law are summarized in a motion filed by the Attorney General to the Supreme Court requesting the declaration of Law 11.952 as unconstitutional. The motion notes that the law departs from its objectives to: promote social inclusion and agrarian justice; protect good-faith land tenants that derive their livelihoods from the lands they inhabit; and to improve controls and monitoring of deforestation in the Amazon. The motion goes further to state that Law 11.952 grants unjustified privileges to land grabbers (*grileiros*) who have illegally appropriated vast areas of public lands. In addition, the law's allowance of an exception to the required visit by authorities to lands claimed by tenants (art. 13) may allow land claims to be filed by fake tenants with the risk that such claims may refer to lands traditionally occupied by indigenous or local communities. Lastly, the motion indicates that the law allows land regularization by those who illegally deforested Amazon lands, without imposing as a condition the rehabilitation of degraded lands, thus illustrating another failure of the law to conform to environmental principles reflected in the Constitution (*Procuraduria Geral da Republica* 2009).

#### 2.6.7 Voluntary instruments promoting social and environmental guidelines for biofuels production

Voluntary agreements are highlighted here as instruments that have been useful to promote social rights and environmental standards in the biofuels production chain. Especially in areas where consensus among states is

elusive, voluntary agreements among industry, government entities and stakeholders pave the way for a higher degree of compliance with environmental and social criteria in the bioenergy sector. The agreements highlighted as most relevant in this field include: the Agreement for the Eradication of Slave Labour, the Soybean Moratorium in the Amazon, and the Agreement between the Amazon and São Paulo States on soybean.

*Agreement for the eradication of slave labour*

The National Pact for the Eradication of Slave Labour (*Pacto Nacional Pela Erradicação do Trabalho Escravo*) is an initiative coordinated by the International Labour Organization (ILO) and two leading Brazilian NGOs focused on corporate social responsibility and combating slave labour. The Pact's signatories agree not to source inputs from firms included in an online list published by the Ministry of Labour and Employment (*Ministério do Trabalho e Emprego*) that identifies firms sanctioned for imposing working conditions analogous to slavery (Ministry of Labour, *Portaria* No. 540, 15 October 2004). Since its adoption in May 2005, the Pact has garnered the signatures of more than 160 firms and associations, and is considered a successful initiative, supporting government efforts to eradicate slave labour conditions that still exist in some rural areas. Of particular interest to the bioenergy sector is the inclusion of several firms in the list that are part of the bioenergy production chain. At the time of writing, the *Lista Suja* contained eight sugarcane producers, affecting 2 294 workers and 31 charcoal producers involving 436 workers.

The crucial work carried out by the Ministry of Labour, through the mobile monitoring group (*Grupo Especial de Fiscalização Móvel*) in combating slave labour has been highlighted by interviewed government and industry sources, even though some considered it necessary to provide more resources to establish wider-reaching enforcement.

*Corporate social responsibility in the Amazon*

On 24 July 2006, the industry associations of the soybean exporters and processors and some of their members, civil society organizations and the Ministry of Environment came together in a Soybean Working Group and established a Moratorium on the Purchase of Soybeans from the Amazon biome. The latest agreement extended the moratorium to July 2010 (art. 1).

The moratorium is a voluntary commitment by the private sector not to engage in the commercialization of soy originating from deforested areas of the Amazon Biome after 24 July 2006. The agreement also includes a private sector commitment to support the government in:

- monitoring soybean plantations in the Amazon biome;
- raising awareness of producers of the need to comply with the Forest Code, and the registration and environmental licensing of rural properties; and
- collaborating on the definition and application of, and compliance with, public policy including ZEE of the Amazon (art. 1).

Civil society organizations also agree to provide technical support to the initiative and to promote the creation of payments for ecosystem services and the preservation of forests (art. 2).

Initially a private sector and civil society partnership, the moratorium earned the support of the government through its Environment Minister, who signed the initiative in 2008. In the 2009 Agreement, the Ministry of Environment agreed to: promote the registration and environmental licensing of rural properties, with priority given to soybean municipalities in the Amazon biome; promote ZEE in the Amazon States (Amazonia Legal); ensure that the map of the Amazon biome is defined at a scale adequate to allow for the monitoring of rural properties; and cooperate in the development of incentives for sustainable production including the payment for ecosystem services (art. 3).

The Soybean Working Group believes the moratorium has been instrumental in the reduction of the annual deforestation rate in the Amazon. Since its inception, progress has been made, for example, through the creation of a combined satellite monitoring system, as well as on-site confirmation with visits and flyovers that allow the identification of firms not respecting the moratorium, which are subsequently eliminated from the list of suppliers of soybean exporter and processing firms.

In 2009, for example, the monitoring of 630 polygons reportedly established a compliance rate of 97 percent (Ministry of Environment 2009). In fact, the information generated by National Institute of Spatial Research (*Instituto Nacional de Pesquisas Espaciais*) on loss of forest cover in the Amazon in 2008 indicated a freezing of deforestation in areas monitored by the Soybean

Working Group and an increase in the deforestation of areas smaller than 100 hectares (which are not yet monitored). Further efforts in monitoring smaller properties and additional government efforts to implement land-registration and environmental licensing for rural properties are expected to contribute to this common effort.

Another initiative is the "Corporate social responsibility for soybean production and trade between the Amazon and São Paulo City Pact" signed in 2008 by 14 institutions including several NGOs, the International Finance Corporation, the ILO and two supermarket chains. The initiative is undertaken through the purchase and financing of soybeans and derivatives from sources that do not employ slave labour and conform to requirements by the Ministry of Environment and the Soybean Moratorium. In particular, the Amazon-São Paulo City Pact does not allow for the purchase of soybean inputs from:

- firms listed in the Ministry of Labour's *Lista Suja* of firms found to employ work analogous to slavery;
- rural properties included in the Soybean Moratorium areas; or
- areas cleared for soybean production under the Soybean Moratorium but identified by IBAMA as being in non-compliance with registration requirements (*areas embargadas* ).

## 3. CONCLUSIONS

With more than three decades of experience in promoting the biofuels sector through government regulations and market-based instruments, Brazil currently runs one of the largest and most successful bioenergy programmes in the world. Although concerns were voiced from early on in Brazil's biofuel history, more recent questions over the environmental and social sustainability of this sector have garnered significant political attention as biofuels have ceased to be thought of simply as sources of energy security and economic growth, but have taken on a decidedly green role in light of potential environmental benefits which they may offer. Amid expectations that international demand for biofuels will grow significantly in the near future, and spurred by policies to both enhance energy security and reduce greenhouse gas emissions primarily in industrialized nations, Brazil's *Pró-Álcool* and Biodiesel programmes have shifted focus to concurrently

improving the environmental and social aspects of bioenergy production and consumption.

Since *Pró-Álcool's* inception, it has focused on diversifying the country's energy matrix and providing tools to increase the competitiveness of the sector, but initially lacked a particular focus on environmental or social criteria. Over the years however, it became more apparent that despite its economic and productive success, Brazil's bioethanol programme had had serious social and environmental consequences, with the government's own Brazilian Agroenergy Plan 2006–2011 acknowledging that sugarcane production had encouraged detrimental effects on land ownership distribution and socio-economic and environmental considerations.

Thus the government has been making strides in addressing these issues and with change visible in recent years. For example, sugarcane producers are working together with state governments to introduce mechanical crop harvesting, reducing both environmental and social negative impacts in the long term. Economic-ecological zoning (EEZ) of sugarcane is underway to aid in better decision-making in sugarcane production and expansion. Additionally, with the inception of the Brazilian government's biodiesel programme in 2005, development objectives such as the promotion of family-based agriculture and provision of technical assistance to small-hold farmers have become a primary focus of the industry.

The following represents a re-cap of elements of the Brazil's biofuels programme which point towards legal and other options for economic, environmental and social sustainability in biofuels development.

### 3.1 General agroenergy policy framework

Although national policy and legislation are primarily concentrated on bioethanol and biodiesel production, the Brazilian Agroenergy Plan 2006-2011 addresses four main products: bioethanol, biodiesel, planted energy forests (for charcoal) and residues from agriculture and forestry (including sugarcane bagasse). It explicitly sets out social, environmental and economic goals that can potentially benefit a wide range of stakeholders. The goals of the Plan are to:

- establish a framework and provide orientation for public and private actions aiming at the generation of knowledge and technologies that

contribute to the sustainable production of energy through agriculture and to the rational use of this renewable energy; and

- ensure the competitiveness of Brazilian agribusiness and support specific public policies, such as social inclusion, regional development and environmental sustainability.

## 3.2 Market mechanisms

### 3.2.1 Creation of a market

Creating a domestic bioenergy market is a complex endeavour, with one of the most challenging aspects being to create demand even in cases where bioenergy production costs often initially outweigh those of alternative (often fossil) sources of energy. In the Brazilian context, the primary regulatory instruments used to meet this challenge are mandates requiring that all gasoline sold in Brazil contain 25 percent bioethanol and all diesel contain 4 percent biodiesel. Drastic production increases since the national biodiesel plan's inception has seen the programme running ahead of schedule to such an extent that in Brazil's National Climate Change Plan of 2008, the original 5 percent blend mandated by 2013 was moved up to 2010. The success of the bioethanol programme on the other hand has both contributed to, and has been boosted by, the introduction of a growing fleet of flex-fuel automobiles that can run on pure gasoline, pure bioethanol or any combination of the two. Sales of these flex-fuel vehicles constitutes over 80 percent of vehicles sold in Brazil, aided by favourable taxation and high oil prices. The creation of this technology for the Brazilian context is illustrative of the spillover effects bioenergy can have in other areas. However, blending requirements should be progressive and flexible, and in conformity with installed production capacity to prevent bottlenecks in the supply. To ensure this flexibility, Brazil has set up a blending range for ethanol, managed by the multi-sectoral Interministerial Sugar and Alcohol Council (*Conselho Interministerial do Açúcar e do Álcool*). The Council may establish blending requirements within the 20–25 percent range adjusting requirements in light of changes in government policy goals, commodity prices and installed capacities. Similarly, in the biodiesel case the inter-ministerial National Council for Energy Policy (*Conselho Nacional de Política Energética*) is also entitled to decide on blending requirements.

### 3.2.2 Fiscal mechanisms

Historically, six instruments were utilized for the promotion of bioethanol production in Brazil, of which only tax deductions and the blending mandate remain at present. The instruments employed to aid in the formation and success of the Brazilian bioethanol industry initially focused on both ensuring security of supply and assurance demand for bioethanol, and included: (i) price controls: the requirement that bioethanol be priced lower than gasoline at the pump; and a guaranteed even price across the nation for all bioethanol producers; (ii) tax incentives for automobiles running on bioethanol; (iii) loans to bioethanol producers for expanding capacity; (iv) the obligation for gas stations to sell bioethanol; (v) the creation and maintenance of strategic bioethanol reserves; (vi) and guaranteed government purchases.

This significant government intervention was, from the very beginning, designed to be temporary, with the industry becoming highly competitive and self-sufficient only after release from governmental price controls. At present, the government still plays a leading role in promoting bioethanol through: regulatory blending requirements, tax deductions to both bioethanol producers and sales of flex-fuel vehicles, and the provision of federal credit to biofuel producers.

## 3.3 Institutional framework for bioenergy

Over the decades Brazil's institutional structure for bioenergy has gone through a dramatic evolutionary process, with the structure of today's system looking very different from that which existed at the outset. For both bioethanol and biodiesel, the institutional set up is complex and multi-sectoral given the agricultural, environmental and energy components of bioenergy. Nonetheless, for bioethanol key entities are found primarily under the Ministry of Agriculture and the Ministry of Energy (under both of which exist a steering committee to develop policy and another body to implement that policy). The Ministry of Environment has a comparatively minor role.

In the case of biodiesel, the explicit social concerns of the programme necessitate a broader range of institutional actors. Playing similar roles to the policy formulation and implementation bodies seen in Brazil's bioethanol programme, the Executive Interministerial Commission on Biodiesel and the Managerial Biodiesel Group (within the Ministry of Energy), are both

inter-ministerial groups, functioning respectively as the policy development and implementation arms of Brazilian biodiesel sector. Both institutions are considered to be effective in allowing a wide range of views to be heard prior to decision-making, and have been relatively successful in consensus building. Concerning the Social Seal, the Ministry of Agrarian Development is responsible for adjusting required smallholder participation and other aspects of qualification for receiving the Social Seal, as well as for approving use of the Seal. Despite the socially inclusive requirements of this programme, the policy-making process remains relatively top-down in nature, with a good level of interagency coordination but without much space for public participation. Also, enhanced transparency in key decision-making processes would lend grater legitimacy to procedures.

## 3.4 Social aspects of the biofuels framework

### 3.4.1 The biodiesel programme

The National Programme for the Production and Use of Biodiesel and its related Social Fuel Seal scheme provide incentives for large biodiesel producers who supply the domestic market, to source from, and improve the livelihoods of, smallholders in economically sensitive regions. Aside from the regulatory blending requirement, the main legal instruments used to promote biodiesel production include tax exemptions for biodiesel producers that incorporate a percentage of input from specific crops (grown in poorer regions) or buy from family-based farming.

In particular, the regionally differentiated incentives have significantly motivated producers to source large portions of their feedstocks from family farmers, to the extent that, in the Northeast, additional production capacity was built up to take advantage of the highly lucrative tax incentives offered. The result was that smallholders were unable to meet the production demanded by processing plants and the required percentage to be sourced from family farms was then lowered in 2009 so that the production plants remained in compliance with the law. In addition, regarding the favourable contractual arrangements, tying economic incentives for producers to interact with rural trade unions has proven to be a conducive mechanism to meet divergent interests in the bioenergy sector. Finally, biodiesel producers are required to provide technical assistance for family farmers in line with government guidelines related to food security and sovereignty, sustainable production systems, generation of income and reducing rural poverty.

Producers are rewarded in this respect, as costs related to such technical assistance are deductible from taxes. This scheme therefore seeks to increase the potential to improve not only the economic performance of farmers in terms of biodiesel production but also their long-term livelihoods as well.

To date, although required by law to be assisted by a union or other cooperative organization, the conclusion of contracts between producers and family farmers in many cases is still rather opaque. Especially when dealing with sensitive social issues such as development options for the rural poor, changes such as the 2009 adjustment in the required amount of smallholder participation discussed in section 2.5.5, should be undertaken in a more transparent manner in the framework of consultations of all concerned stakeholders.

While economically the programme has seen enormous success, the impact of social criteria – and their readjustment – should be closely monitored to ensure a large number of family-based farmers are actually benefiting from the system. In addition, the Social Fuel Seal scheme should be further developed to address also environmental sustainability concerns. The following are options to enhance the overall sustainability performance of the Social Fuel Seal programme, including the inclusion of environment protection criteria:

- It may be useful to incorporate requirements into the Seal that promote the respect of ZEEs for soybean when these are developed, ensuring that soybean plantations do not result in deforestation or the destruction of vulnerable ecosystems.

- It would also be helpful to continuously monitor and evaluate the percentages of raw materials that must be sourced from family farmers and cooperatives, and the promotion of technical assistance to farmers. Independent verification of the impacts of the Social Fuel Seal on poor farmers, especially in the most disadvantaged areas, will be key to ensuring that the objective of the seal is achieved on the ground. Monitoring the programme's effects on family farmers could be based on indicators showing: numbers of farmers that benefit from the system; areas where these farmers come from; and benefits received compared to alternative land uses in those areas. The total area of soybean production and its growth into marginal or vulnerable ecosystems should also be closely monitored, and feed into ZEE strategies.

- The Social Fuel Seal scheme should contain an explicit stipulation that certified bioenergy production conforms to all environmental requirements included in other sectoral legislation, including, for example, environmental impact assessment regulations and the procurement of inputs from suppliers that comply with the registration requirements of the Brazilian Institute of Environment and Renewable Natural Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis- IBAMA*). This would be important not only to supply the domestic market – where compliance with such requirements may be evaluated at other points – but to ensure that biodiesel exported with the Social Fuel Seal may be interpreted as being in compliance with applicable federal and state environmental and forest protection legislation as well.

- Another aspect to be considered is the granting of the Seal to small biodiesel plants, which may thus be able to enter domestic and international markets. In order to accomplish this, the capital requirement of 500 000 Brazilian reals established by the Ministry of Finance will have to be eased.

#### 3.4.2 Social and environmental considerations of sugarcane harvesting

Manual harvest of sugarcane is usually associated with very harsh working conditions for labourers. Such conditions have to do with the climate, lack of provision of adequate food, accommodation and safety equipment, or the respect of labour laws by some sugarcane producers.

Aside from enforcing existing regulations on labour standards in Brazil, a key factor cited by interviewed persons was the reform of the labour market mechanisms. In particular, the industry's system of payment, based upon tons harvested, does not provide incentive for employers to respect labour standards and tends to shorten the working life of labourers who are pressed to perform unsustainable levels of physical exertion. Improved labour conditions could thus be provided through: a ceiling on permissible tons harvested per worker per day set out on the basis of medical standards for healthy and sustainable effort or payment per hour; maximum number of hours; medical insurance schemes or medical support options; and a minimum wage.

Besides regulation, it is worth noting other approaches adopted to improve the social aspects of the bioenergy section. Brazil has a National Plan for the Eradication of Slave Labour, and regularly updates a list, available online, which includes all firms that have been found to impose working conditions analogous to slavery (known as the *Lista Suja*). Government efforts are also supported by a voluntary agreement for the eradication of slave labour.

The promotion of mechanized harvests, coupled with restrictions on sugarcane field burning – a method usually used to 'soften' the cane prior to manual harvesting – are key to promoting improvements in the health and environmental conditions of sugarcane production. Mechanized harvesting require a maximum slope of the terrain limiting the possibilities for its use in all regions (most notably in many areas of the Northeast, where approximately 30 percent of sugarcane production still takes place). In São Paulo state, where most sugarcane is cultivated, an agreement with the national sugarcane industrial union has been adopted to end the practice of sugarcane field burning by 2014 in most areas where mechanization may take place (in addition to a São Paulo state law requiring the end of this practice completely by 2021). This policy is conducive to improving working conditions in the sugarcane sector and is coupled with agreements to train cane cutters in preparation for their re-entry into the labour market.

As a result of mechanization, not only is additional sugarcane residue available for energy and bioethanol production purposes, but avoiding burning of sugarcane fields also contributes to reducing carbon dioxide emissions and preventing pollution and its health-related problems. The trade-off for leaving the harsh labour conditions of the cane fields behind is unemployment for many seasonal workers, something which must be monitored and minimized. In this regard, government policies targeted at the areas of origin of these workers – who are generally migrant workers – combined with stricter policies requiring sugarcane producers to support government efforts in the reemployment of cane field workers should be introduced, which may be funded at least in part by the increased profits which will be enabled by mechanizing the harvesting process.

### 3.4.3 Voluntary agreements

Voluntary agreements between the government, industry and civil society are useful to advance and support government policy regarding the social and environmental sustainability of bioenergy crops. These agreements evidence

a proactive approach to engage industry and civil society in public policy formulation and implementation. The Soybean Moratorium Pact has allowed the biodiesel industry to join forces with governmental and non-governmental actors to ban the purchase of soybean from Amazon producers. The Pact has been reported to be successful in requiring suppliers of the vegetable oil industry to comply with land registration requirements. This also paves the way for the future adoption of a ZEE for soybean in Brazil.

The Pact for the Eradication of Slave Labour is an example of a voluntary agreement among private sector firms and associations in support of government labour policies, which commits the signatories to refrain from purchasing any input from firms listed in the *Lista Suja*. Such an agreement is useful to raise awareness of the need to eradicate illegal working conditions and to promote compliance with national regulations and labour laws.

The success of these voluntary initiatives ultimately depends on a sustained effort by the national government to continue monitoring labour and environmental conditions.

### 3.5 Environmental aspects of the biofuels sector

A set of regulatory mechanisms, featuring compulsory instruments and voluntary schemes, are already being tested in Brazil to promote biofuels sustainability focusing on an improved consideration of environmental criteria. Voluntary agreements and intra-market agreements, as well as international pressure and requirements for exports, have been cited as key drivers for improvements of labour conditions.

Considering Brazil's negative experience with the environmental impacts derived from the sugarcane monocultures and the significant productivity gains in the last decades, most recommendations related to sustainability of this crop point towards limiting the expansion of the agricultural frontier towards fragile or valuable ecosystems. This could be accomplished with ecological-economic zoning (ZEE) laws, which appears to be the intention of ministries and stakeholders concerned with protecting, in particular, the Amazon and Pantanal biomes. The primary method by which these zoning laws are implementation is the linking of governmental agricultural subsidies and credits to particular zones. Therefore, in addition to the technical criteria used as a basis to define land areas appropriate for sugarcane cultivation, key

components of an appropriate zoning strategy would be tying federal credit, insurance or other types of economic incentives with compliance with zoning requirements. Monitoring systems to assess compliance would also be an important constituent.

Brazil's ZEE for sugarcane, although pending final government endorsement, is a valuable example of a zoning strategy that is based on economic, social, agricultural, food security and environmental criteria. As this will be the first bioenergy crop to use the ZEE system, it will likely form the basis for other ZEEs in bioenergy crops such as soybean, and therefore the establishment of a credible, legitimate system now will be crucial in ensuring support for subsequent ZEEs.

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