

BIODIESEL AND ITS CONTRIBUTION TO BRAZILIAN DEVELOPMENT



FUNDAÇÃO
GETULIO VARGAS
FGV PROJETOS


Ubrabio
União Brasileira do Biodiesel

INTRODUCTION

This publication is a joint effort by the **União Brasileira do Biodiesel (Ubrabio)** and **Getulio Vargas Foundation** to more clearly understand a frontline project in the Brazilian economy, the National Biodiesel Production and Use Program (PNPB).

At the current stage of Brazilian development, closely associated with social inclusion, this is an undeniably successful project. In only five years, the country has taken an enormous leap in biodiesel production, with the private sector strongly following government signals. This role today makes it urgent to create a new regulatory benchmark resulting in more investments, income and job generation and a larger share of family farming, especially in the less developed regions of Brazil.

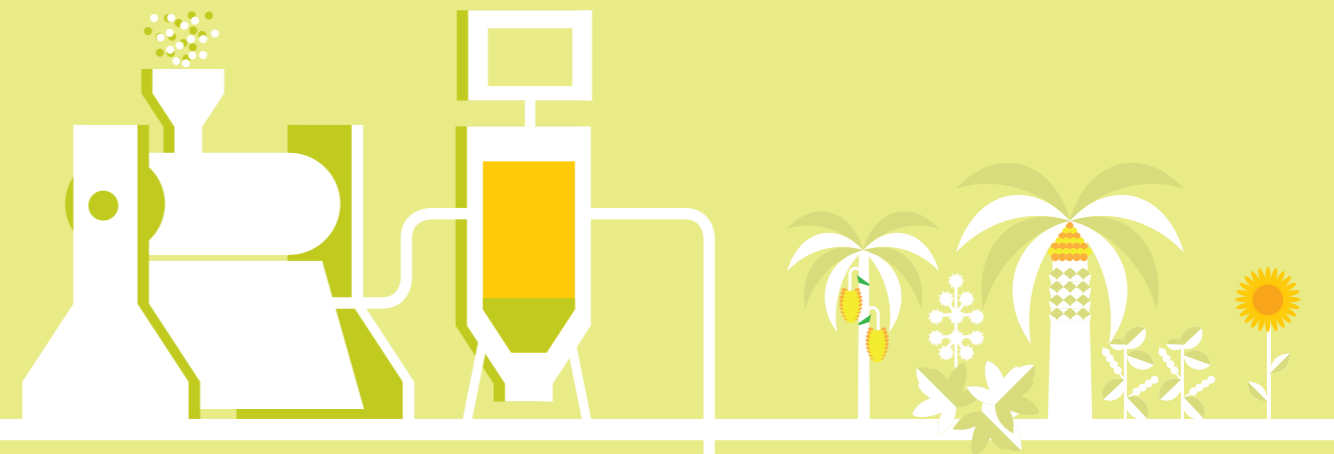
This paper provides a widespread analysis of the biodiesel chain and its importance for the country's economy, considering the production of feedstock, the industrial sector, questions involving health and the environment, impacts on the trade balance, social benefits and destination of the products. Lastly, there is a discussion of the benefits to be created by increasing biodiesel production, based on forecasts to reach higher mix percentages in the next few years, to reach the metropolitan B10 and B20 by 2014 and by 2020 for B20 to be nationwide.

In a few words, this is a valuable study for all those interested in the directions of the Brazilian economy and in the best choices for enhancing the course of sustainable development.

The current challenge for the biodiesel industry is in the construction of an environment favorable to its expansion, to avoid restrictions on its growth and maintain their virtuous path. The program's success should not be seen as a result already established in the future. It is necessary to expand the current mix volumes to consolidate confidence in the ability to maintain sustainable growth and industry competitiveness in the long term.

BIODIESEL IN A FEW WORDS

Created in 2005, the National Program for Biodiesel Production and Use (PNPB) is a valuable opportunity for generating wealth, social inclusion and quality of life.



SOCIAL BENEFITS

Decentralization and increased oilseed production are structuring factors for developing less privileged regions and family farming.

In 2010, R\$ 980 million must be spent on procuring feedstock from family farming, involving 100,000 families.

By adopting a goal of 20% biodiesel by 2020, the number of hospital admissions from respiratory problems relating to diesel fuel combustion will drop considerably with 77,000 hospital admissions that year.

In this same scenario, 11,000 deaths a year from pollutant emissions of fossil diesel will be prevented.



ENVIRONMENTAL BENEFITS

Today Brazil is one of the few countries in conditions to expand the farm production without harming its biodiversity.

Adopting higher contents of biodiesel mixed with regular fossil diesel represents a major drop in hydrocarbon emissions.

The fuel helps mitigate the high sulfur contents in fossil diesel.



TECHNOLOGICAL BENEFITS

The PNPB is the main agent for developing various oilseed crops.

The national industrial complex is highly developed, with more than 60 producing plants that could immediately achieve the B10 target.



MARKETING BENEFITS

Between 2005 and 2010, around R\$ 4 billion was invested in the biodiesel industry and 1.3 million jobs created.

In the course of adopting 20% of mix by 2020, 532,000 direct jobs and six million indirect occupations will have been created.

With biodiesel, Brazil can in 2020 export approximately 28 million tons of soy bran and obtain income of US\$ 8.4 billion.

The increase in bran production used as animal feed enables a larger supply of animal protein, namely, meat in general.

With a 10% mix of biodiesel in diesel, the country would have saved US\$ 2.2 billion from January to June 2010 alone by not importing diesel.

A study by **Ibre-FGV** shows that the adoption of the mix does not cause inflationary impact.

The PNPB encourages regional development.

Biodiesel can be a price reference base, guaranteeing the procurement of feedstock in cases of a drop in oilseed prices.

SECTORAL CHALLENGE

The biodiesel sector needs to build a favorable conjuncture for its expansion to maintain its virtuous course.

It is necessary to increase the current mix volumes to consolidate the trust in the growth capacity, setting a new benchmark.

Cleaner and renewable energy, with income and employment in the countryside

Brazilian biodiesel production has grown fast and helps achieve more ambitious targets – the installed capacity is enough to immediately meet the 10% demand of mix in fossil diesel

The National Program for Biodiesel Production and Use (PNPB) is a groundbreaking project created in 2005 to further the production and use of this fuel in Brazil. This is not only an alternative source of energy but also an opportunity to create jobs and income in the countryside.

Biodiesel can substitute all or part of fossil diesel fuel in automobile diesel cycle engines (trucks, tractors, vans, cars, etc.). It can be used pure or mixed with diesel in different proportions. The mix of a percentage of biodiesel with mineral diesel is called "BX" in which "X" is the biofuel content, and the B5 corresponds to a 5% mix of biodiesel with diesel and so on successively, until pure biodiesel called B100.

Biodiesel has become more important in recent years around the world. Countries such as Argentina, Brazil, France, Germany (largest world producer), Italy, Malaysia and the USA produce a large quantity of biodiesel.

The biodiesel production chain has the potential to encourage the production development of other oilseed varieties and boost the development of poor regions throughout Brazil.

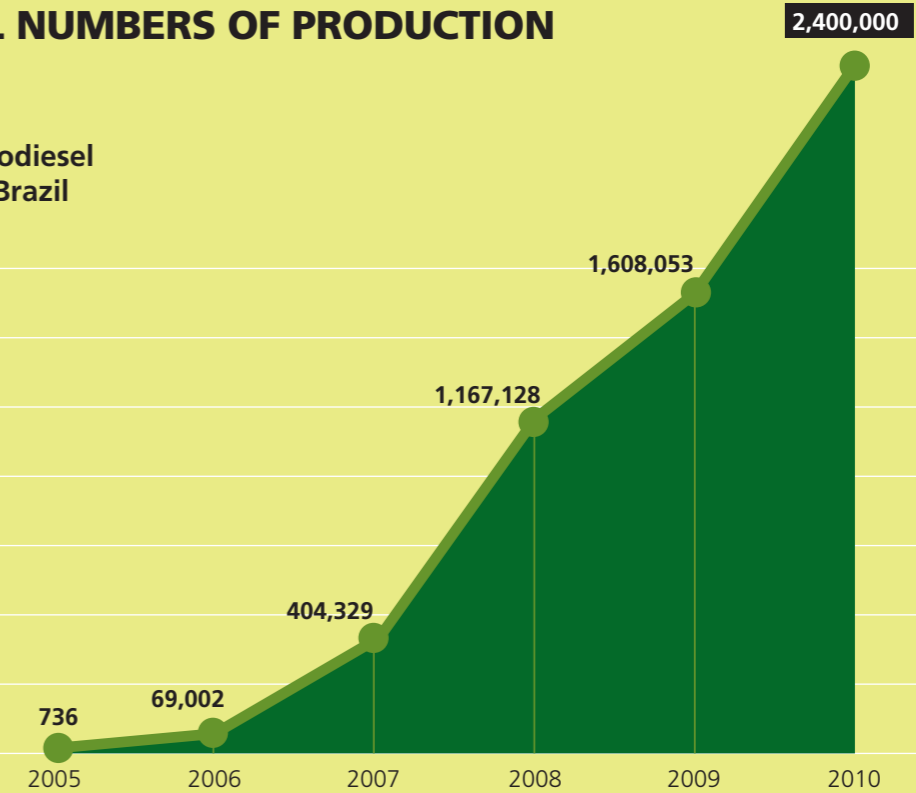
Some of the various benefits of its use are as follows:

- It is renewable energy;
- High job and income generating potential, especially in the countryside;
- Less polluting than diesel, providing a major environmental plus;
- Enables the use of carbon credits;
- Is an excellent engine lubricant;
- Its risk of explosion is low, which facilitates questions relating to transportation and storage.

At the time when Law 11,097/05 was approved, which introduced biodiesel into the Brazilian energy matrix, there were uncertainties about whether the country would be able to or not develop feedstock production and processing capacity to meet the demand from adding 2% biodiesel to diesel fuel. However, the biodiesel industry responded to the prospects created by the new demand in the Brazilian market and increased its production and installed industrial capacity. The market's response was quite positive, which motivated the government to advance the implementation of the mandatory mixes B3, B4 and B5, to achieve the target fixed in the law three years earlier than the date initially planned. In the last two years, production grew significantly as a result of the mandatory mixes. In 2009, for example, when the mandatory mix increased from 3% to 4%, there was an increase of approximately 38% compared to 2008.

OVERALL NUMBERS OF PRODUCTION

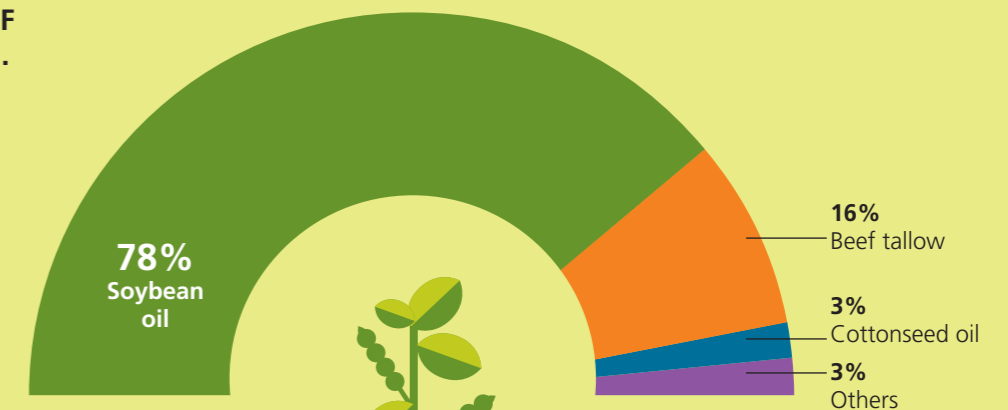
Volume of biodiesel produced in Brazil
Production (m³)



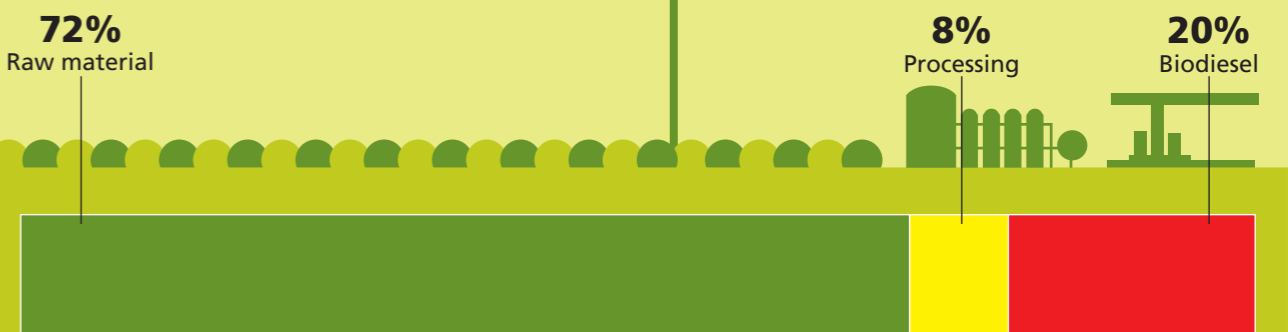
Source: ANP 2010, adapted by FGV Projetos

PARTICIPATION OF RAW MATERIAL...

...in biodiesel production



...in biodiesel value chain



Source: ANP and FGV Projetos



Biodiesel has become more important in recent years around the world. Countries such as Argentina, Brazil, France, Germany (largest world producer), Italy, Malaysia and the USA produce a large quantity of biodiesel. In Brazil, investments in research are of great importance

The biodiesel production sector continues to expand to permit more ambitious targets. The authorized installed capacity is currently around 5.1 million m³, more than the need to meet the demand created by B5 and very close to the forecast demand for a possible B10 in 2014 – and shall increase even further with the consolidation of the projects currently in progress. The biodiesel production chain has the potential to encourage the produc-

tion development of other oilseed varieties and boost the development of poor regions throughout Brazil.

FEEDSTOCK

Competitiveness, technology and diversified crops

Soy is the ballast for producing biodiesel and the PNPB incentivizes production of other types of oilseeds until then little used, developing know-how and fostering family farming.

The biodiesel industry in Brazil is recent but is already showing how important it is for a very promising segment of the Brazilian farming sector: oilseed production. Brazil has a wide range of species that can be used, namely soy, palm, castor oil plant, sunflowers, cotton, babassu, peanuts, *Jatropha curcas* [Barbados nut], canola, crambe and sesame, for example. Although this sector has attracted large global groups over the past ten years to operate in the soy production chain, Brazil today is experiencing a moment of unique growth in the diversification in the production of other oilseeds.

The biodiesel industry, boosted by the PNPB, has a strong presence in various regions of the country in developing new oilseed chains. And motivated by the federal government program – Social Fuel Seal – the biodiesel industry incentivizes family farming to diversify the production of oilseed crops.

Feedstock production for biodiesel is 72% of the entire value of the chain created by this fuel. Ballast for this feedstock supply for biodiesel production has been soy and although there are good prospects for other oilseeds to participate, soy shall continue as the basic feedstock for biodiesel production in the forthcoming years.

Decentralization of biodiesel production is a structuring factor for developing oilseed production complexes in Brazil. The country has possibilities for diversifying its supply chain, with a vast range of oilseed options for the different climate and

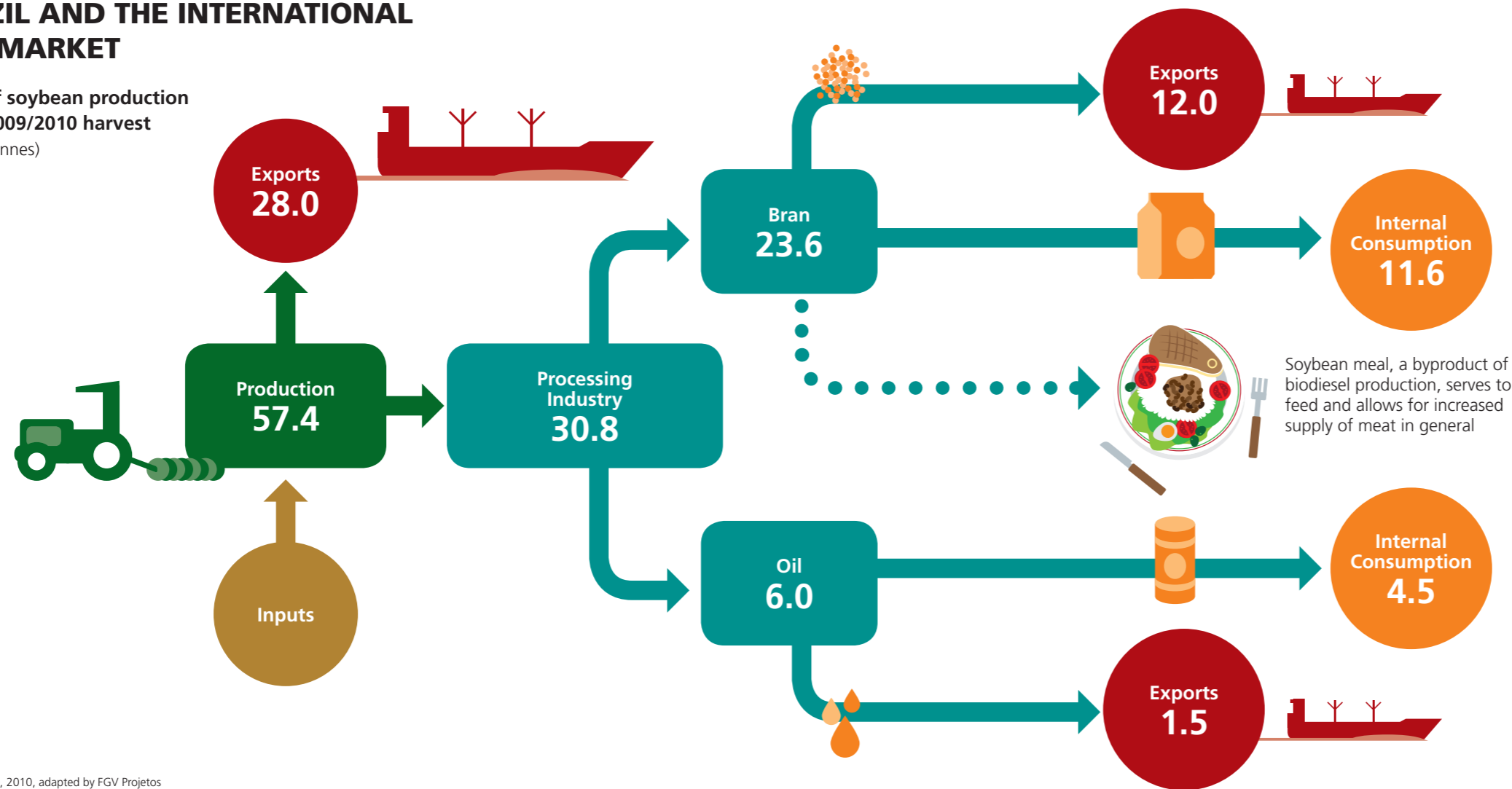
soil situations. In this process, family farming plays a decisive role, since it is more flexible for crop management, mainly in perennial crops, where there normally is more dedication. The model that is being adopted by the biodiesel industry is to supply intensive technical assistance to the small farmer in order to guarantee best practices in crop management, and productivity indices that help obtain a minimum income base.

Another key factor in the Social Fuel Seal program is the non-mandatory nature of using the directly procured feedstock volumes in biodiesel manufacture. This practice also enables high value added oilseed development, where the prices differ from those usually found in the biodiesel industry. The industry can pass on to other production chains the product procured from family farming.

The model that is being adopted by the biodiesel industry is to supply intensive technical assistance to the small farmer in order to guarantee best practices in crop management, and productivity indices that help obtain a minimum income base.

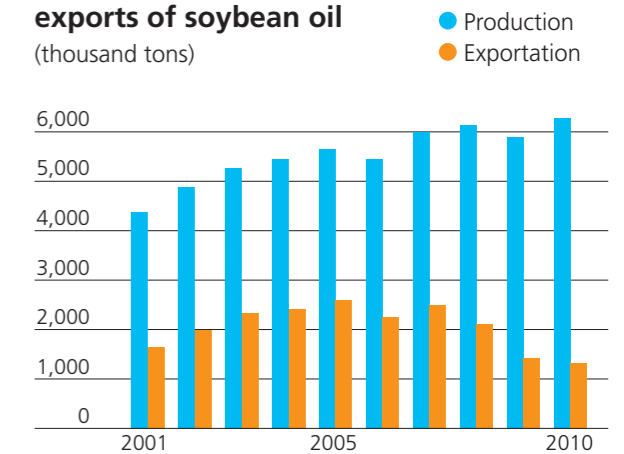
BRAZIL AND THE INTERNATIONAL SOY MARKET

Chain of soybean production in the 2009/2010 harvest (million tonnes)

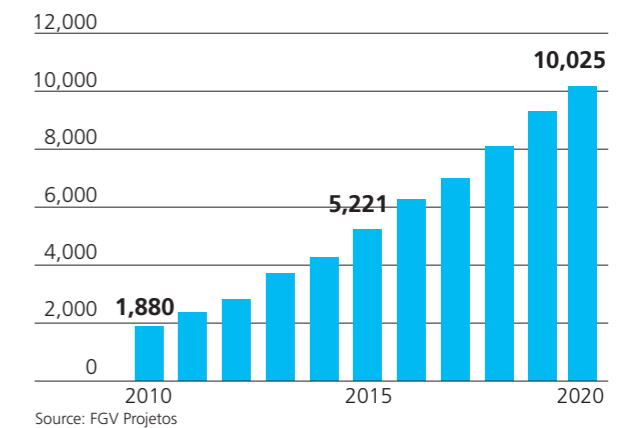


Source: Abiove, 2010, adapted by FGV Projetos

Brazilian production and exports of soybean oil (thousand tons)



Projected demand for soybean oil with a scenario for the B20 in 2020 (thousand tons)



Source: FGV Projetos

BRAZILIAN PARTICIPATION IN THE GLOBAL SOYBEAN MARKET (GRAIN)

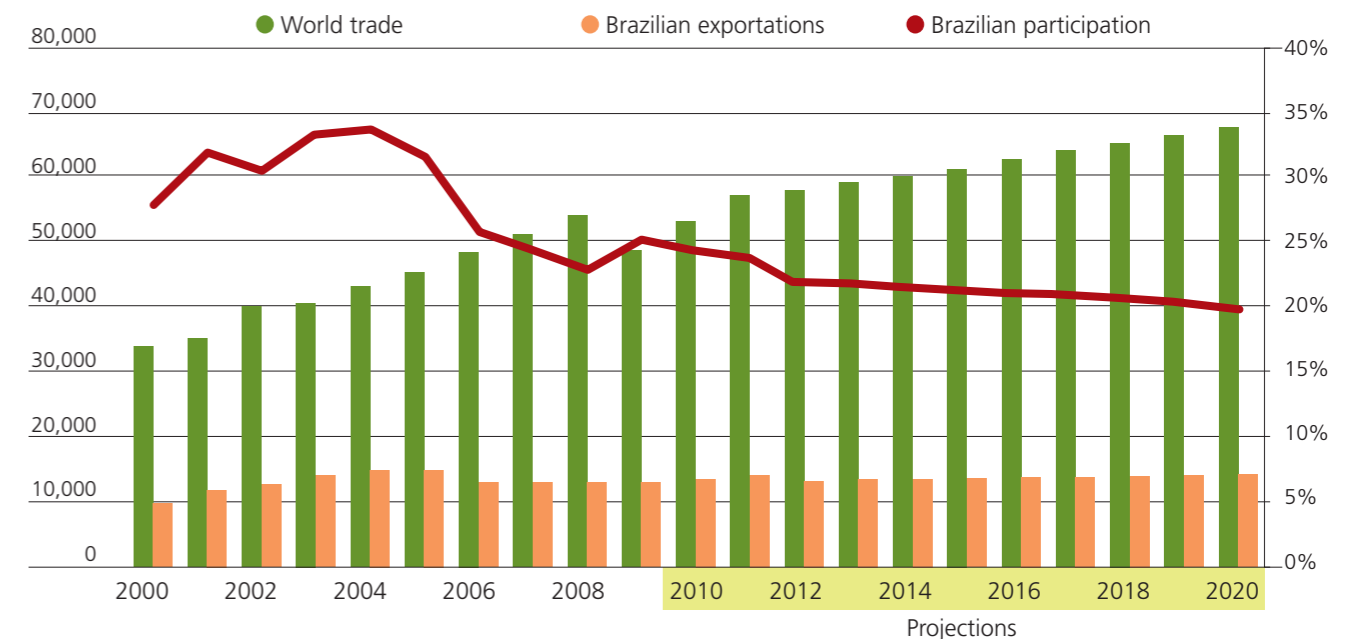
Without considering the regulatory framework of B20 in the projections (thousand tons)



Source: World Oilseeds and Products-FAPRI 2010 Agricultural Outlook, Adapted by FGV Projetos

BRAZILIAN PARTICIPATION IN THE GLOBAL SOY BRAN MARKET

Without considering the regulatory framework of B20 in the projections (thousand tons)



Source: World Oilseeds and Products-FAPRI 2010 Agricultural Outlook, Adapted by FGV Projetos

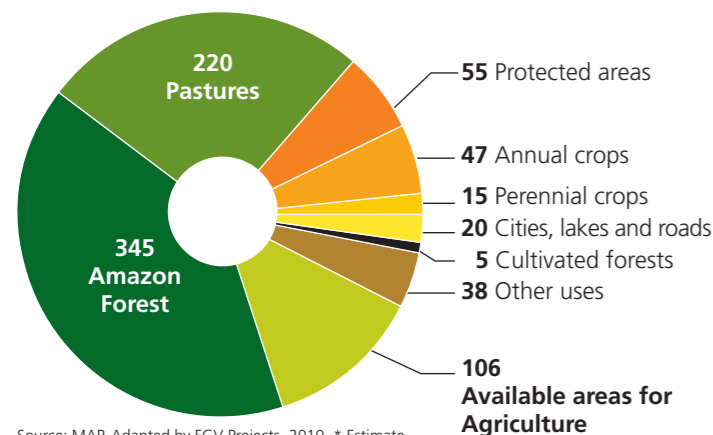
SOY COMPLEX

Soy production in Brazil spread fast in the early 1970s with a typically agroindustrial production. At the same speed as the increase in cropping, crushing plants were set up to process the soybean into oil, including refining the oil for human consumption and also to produce raw soy hulls. Since then, Brazil, especially in the Midwest, became one of the world's leading soybean producers and also one of the major agroindustrial complexes that involves poultry meat production and processing. Today Brazil is the world's second largest soybean producer and processor, second world exporter of soy hulls and third largest soybean oil exporter. Soy is one of the main sources of the country's foreign currency, with approximately 10% of the country's exports and employing around 1.4 million people. Brazilian has a major share in the world soybean market. In recent years, the market has grown 7% a year, leveraged mainly by the food and animal protein industry.

Soy cropping in Brazil tends to increase in abandoned or degraded areas, mainly boosted by the project known as the "Soy Moratorium" headed by the Brazilian Oilseed Industry Association (Abiove) and the Brazilian Cereal Exporters Association (Anec), which agreed not to trade any soy from the Amazon biome in areas that have been deforested since 2006. This project should be a valuable contribution to maintaining and even expanding the of Brazilian soy share in the international market, since it will come in contact with the best management practices with the sustainable use of natural resources, seeking to combine environmental preservation with economic development.

BRAZILIAN TERRITORIAL DISTRIBUTION

(million hectares*)



Source: MAP, Adapted by FGV Projects, 2010. * Estimate

In Brazil today there are around 106 million hectares of available arable land, as well as approximately 220 million hectares of under-utilized pastureland, of which a fraction could be converted to farm production. Therefore, Brazil today is one of the few countries that are in conditions to expand farming production with lower impact on its biodiversity. It is possible then to consider that there are no restricted areas for soy expansion in Brazil.

Soy hulls and added value

According to the Ministry of Agriculture, the soy cropping area in Brazil should increase from the current 23.5 million hectares to somewhere around 26.5 million hectares by 2018; in other words, that year there would already be feedstock to fulfill the forecasts of B17. In this scenario Brazil would naturally now direct its exports to higher value-added products in the soy production chain, such as, for example, soy hulls, and would significantly reduce its soybean exports. The soy base in Brazil shows therefore elasticity to absorb the demands of the biodiesel industry in the next few years, thus keeping its position as major alternative ballast, giving secure feedstock supply to assure development of other oilseeds in the country.

When processing soy, the hulls on the home market have played a major role in strengthening the protein industry in Brazil, guaranteeing a major share in world trade. In soy hull exports, Brazil has lost much of its share on the international market mainly to Argentine exporters. From 1999 to 2009 the world soy hull trade grew more than 5% a year, while Brazil lost its large market share, its exported volumes practically at a standstill. According to the Food and Agricultural Policy Research Institute, the North American agency that prepares market predictions for the farming sector, Brazil as it stands today should practically maintain the current volumes of soy hull exports in 2020, indicating that exports of the Brazilian product will not accompany the growth in international demand.

There is, however, elasticity in the world market for Brazil to leap from its current 20% market share to around 40%, the same share in the global soy hull market that it held in 1996, which would in 2020 be approximately 28 million tons of exports and an annual income of US\$ 8.4 billion.

One factor that can contribute to increasing soy hull exports is the incentive to upgrade the Brazilian crushing plants. Accordingly, instead of exporting soybeans, Brazil could crush them and export the

hulls, increasing the product's added value, as well as being able to use the oil to produce biodiesel. Some countries indirectly incentivize crushing in detriment to soybean exports, such as Argentina, where the soybean has a 35% export duty. It is of the utmost importance for the government to regulate the sector, pointing out to the stakeholders in the biodiesel production chain which percentages will be adopted by the year 2020.

Input for animal protein

Today Brazil is a major world producer of animal protein, the leading world exporter of chicken and beef and its importance is growing in the pork market. According to data from the US Food and Agriculture Organization (FAO), poultry production should have around 40% growth by 2020. This consumption will be boosted mainly by developing countries, which should have a sharp growth in the next few years. The demand from these countries is explained by the increase in per capita income and urbanization, reinforced by the population growth, which is twice that of developed countries, reinforcing the global upward trend for animal protein consumption, as is happening now in Brazil, China and India.

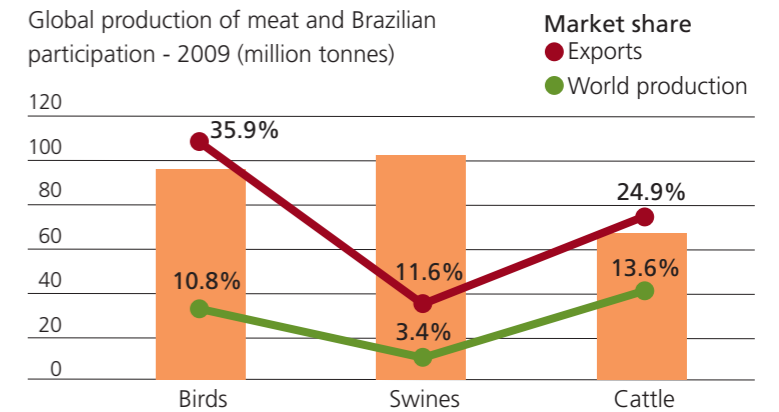
The protein market growth in the world should leverage consumption of soy hulls, principally for manufacturing food for poultry and swine. On average, 20% of soy hulls are used in animal diets, which is around two thirds of the world soy hull consumption; in other words, of the global production in 2010 estimated at 53 million tons, around 35 million tons of soy hulls will be sold worldwide for animal food production. It is therefore estimated that the world would have to sell around 45 million tons of soy hulls in 2020 and Brazil, in this context, could supply a large part of this volume.

There is also the possibility of soy protein consumption by part of the confined cattle herd. The Brazilian and global confined herd tends to increase, which may boost the consumption of protein soy hulls, especially if its price was to drop, in addition to freeing land for grain production, currently occupied by extensive cattle farming.

The surplus soy hulls produced with B20 in 2020 could feed more than 20% of the Brazilian cattle herd, if it is in confinement. Besides absorbing the hull surplus, it is an important fact for the meat industry, since confined cattle can provide top quality meat, and may even leverage the prices of Brazil's meat exports.

BRAZIL AND THE ANIMAL PROTEIN MARKET

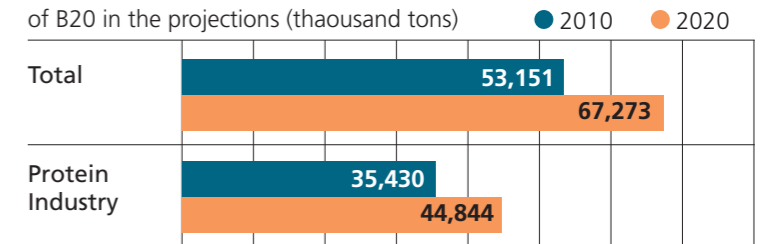
Global production of meat and Brazilian participation - 2009 (million tonnes)



Source: ABEF, USDA, adapted by FGV Projects, 2010

World Trade Bran

Without considering the regulatory framework of B20 in the projections (thousand tons)



Source: FAPRI and USDA, adapted by FGV Projects, 2010

Soy oil production

In the 2009/2010 harvest, Brazil produced approximately six million tons of soybean oil, 1.46 million of which was exported as crude soybean oil. Twenty-five percent of the domestic soybean oil consumption of 4.52 million tons went to the biodiesel market, the rest going to the other markets. Around 90% of oilseed production in Brazil comes from soy. The crushing industry depends heavily on this crop and although there is an increased production of other oilseeds, this scenario should not change in the forthcoming years. Although soybean oil production has been on the increase in Brazil, export levels have dropped in recent years. This may be explained by the fact that Brazil has exported a larger quantity of natural soybeans, bypassing the processing of extra production quantities.

Investments to increase the processing capacity of the soy complex in Brazil were obtained mainly as a result of the need to accompany the demand from the food market, followed by the biodiesel market. Over the past ten years the processing industry so-

ared from a production of 108,000 to the current 166,000 tons a day; that is, an approximately 54% increase in processing, practically accompanying the domestic demand for soy hulls and oil.

Oilseed is the main input for manufacturing biodiesel and today only soybean oil is available to produce large quantities of biodiesel in the country. Around 80% of biodiesel manufactured in Brazil is produced from this oil. The present and future importance of this feedstock should continue at a high level until the consolidation of new production centers of other oilseeds, contributing significantly to guarantee future demands of the Brazilian biodiesel program. The growth of the national biodiesel industry through the planned increase in the biodiesel mix in diesel is of the utmost importance for the Brazilian soy base, and should contribute to strengthening the entire soy production chain, keeping Brazil as a candidate for world leadership in the sector.

The soybean oil share as feedstock for the biodiesel industry will drop from the current 80% to 70% in 2020, which means a further eight million tons or so of soybean oil in relation to the predicted volume in 2010. It is worth mentioning that the drop in the soybean oil share in the biodiesel industry is being predicted on a growing base; in other words, the volume of other oilseeds will increase by approximately 3.9 million tons, which would mean an increase of around ten times the current oilseed production, other than soybean oil.

OTHER FEEDSTOCK

Under government programs to include family farming, other oilseeds should contribute much more to biodiesel production in Brazil. Various oilseeds have potential to diversify the biodiesel production matrix. However, their use also depends on research that defines the best technological package of farm production and industrial processing.

Biodiesel is responsible for the increase in oilseed production, and producers of this fuel in order to obtain the Social Fuel tend to increasingly encourage diversification of feedstock based on family farming, using settlements, fixing people in the countryside. The characteristics of the main potential feedstock for diversifying the production chain are listed below:

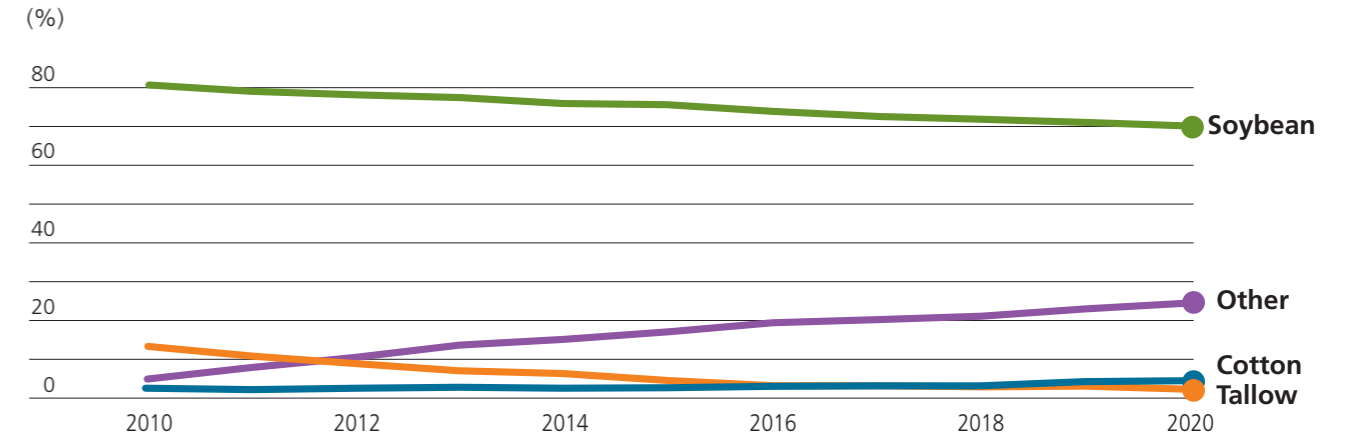
- **Palm** (dendê), perennial crop with economic life of 20-30 years. "Even I want to plant palm", said President Luiz Inácio Lula da Silva, when he launched this crop's sustainable production program.
- **Peanuts**, a short-cycle legume, used in cropping rotation.
- **Canola**, winter oilseed.
- **Sunflower**, annual oilseed, outstanding for its higher resistance to drought, cold and heat.
- **Castor oil plant**, oilseed well adapted to the semi-arid region.
- **Suet (beef tallow)**, sub-product of cattle farming.
- **Cotton seed**, with comparatively few water requirements.

In addition to the aforementioned oil sources, there is a wide range of promising crops, targets for major investment in current research. Some of these crops worth mentioning are *Jatropha curcas* [Barbados nut], *sesame*, *babassu*, *crambe* and other palms.

The potential development of other oilseeds is fairly high. The PNPB shall be the main agent for technological development of oilseed crops, which, prior to the program, was of little importance in Brazilian agribusiness. This advance will occur not only in research and development of new varieties and crops, but also in technical assistance programs.

It is worth mentioning that such projects contribute to technological advances with regard to cultivating various crops so far underexplored. Petrobras, for example, plans to invest US\$ 3.5 billion in biofuels in the next four years, and Embrapa Agroenergia is starting a partnership with

ESTIMATES OF THE SOURCES OF RAW MATERIAL FOR BIODIESEL BY 2020



Source: FGV Projetos, 2010

the National University of Brasilia in the area of agroenergy research. One of the focal points is domestication of new crops, namely the *Jatropha curcas*, for example.

If the oil produced has high commercial values, biodiesel could act as a price reference base, guaranteeing feedstock procurement in event of a drop in the oil price, and procurement of these raw materials by the producer can help them obtain the Social Fuel Seal, regardless of the oil's destination.

Soy participation has oscillated between 75% and 85% while suet is occupying a 10-25% range. Such swings occur each month and can be explained by several factors, such as harvest times of the raw materials, price variation, and so on. This is why average participation figures were adopted. Taking into account the government's and producers' efforts to diversify the feedstock sources, there will be a gradual increase in the share of the other oilseed by 2020. In the case of soy, an annual 1% drop in its share was considered to reach a 70% level in 2020.

For the scenario adopted, the occupied area in 2020 with oilseeds other than soy (excluding the availability of extensive cattle farming areas that can be converted to intensive confinement systems), would be around two million hectares, no mean figure when considering Brazil's 100 million hectares or so available for agriculture. This would also involve in the period monetary circulation of approximately R\$ 15 billion in investments alone.

The estimated oil sale figure of other oilseed crops for 2020 is approximately R\$ 5.75 billion. This shows the potential to generate wealth by diversifying feedstock sources, wealth that tends to be distributed among the producer states, most of which are in North, Northeast and Midwest Brazil.

The volume of other oilseeds will increase by approximately 3.9 million tons, which would mean an increase of around ten times the current oilseed production

Large capacity to meet demands and advance targets

The Brazilian biodiesel industry should produce around 2.4 million m³ in 2010, or only 47% of the installed capacity. There is, therefore, extra capacity to expand the national program.

The Brazilian home biodiesel market has opened up major opportunities for development. It is worth mentioning the characteristic of decentralizing biodiesel production, where being close to where the feedstock – oilseed – is produced is a strategic requirement, and the generation of wealth is much better distributed geographically.

The production plants are distributed in a more or less homogeneous fashion in South, Southeast and Northeast Brazil, corresponding to 25%, 17% and 12%, respectively, of the installed capacity; on a smaller scale 4% in North Brazil. The Midwest is outstanding with 29 plants and 42% installed production capacity.

The Brazilian biodiesel industry should produce 2.4 million m³ in 2010, or 47% installed capacity, a sign of under-utilization of the production structure. Even so, Brazil is the world's second largest industrial base and third largest biodiesel producer, just behind the USA and Europe.

Investments in the production base have been made at a fast rate, accompanying the challenges imposed by the PNPB. In 2005, when the program

began, there were eight biodiesel plants installed with an annual production capacity of 85,320 m³. In 2008, this annual production capacity soared to 3.3 million m³, and today has leaped to approximately 5.1 million m³, in a base of 63 production plants. This total is now able to immediately meet the demand for a B10 mix.

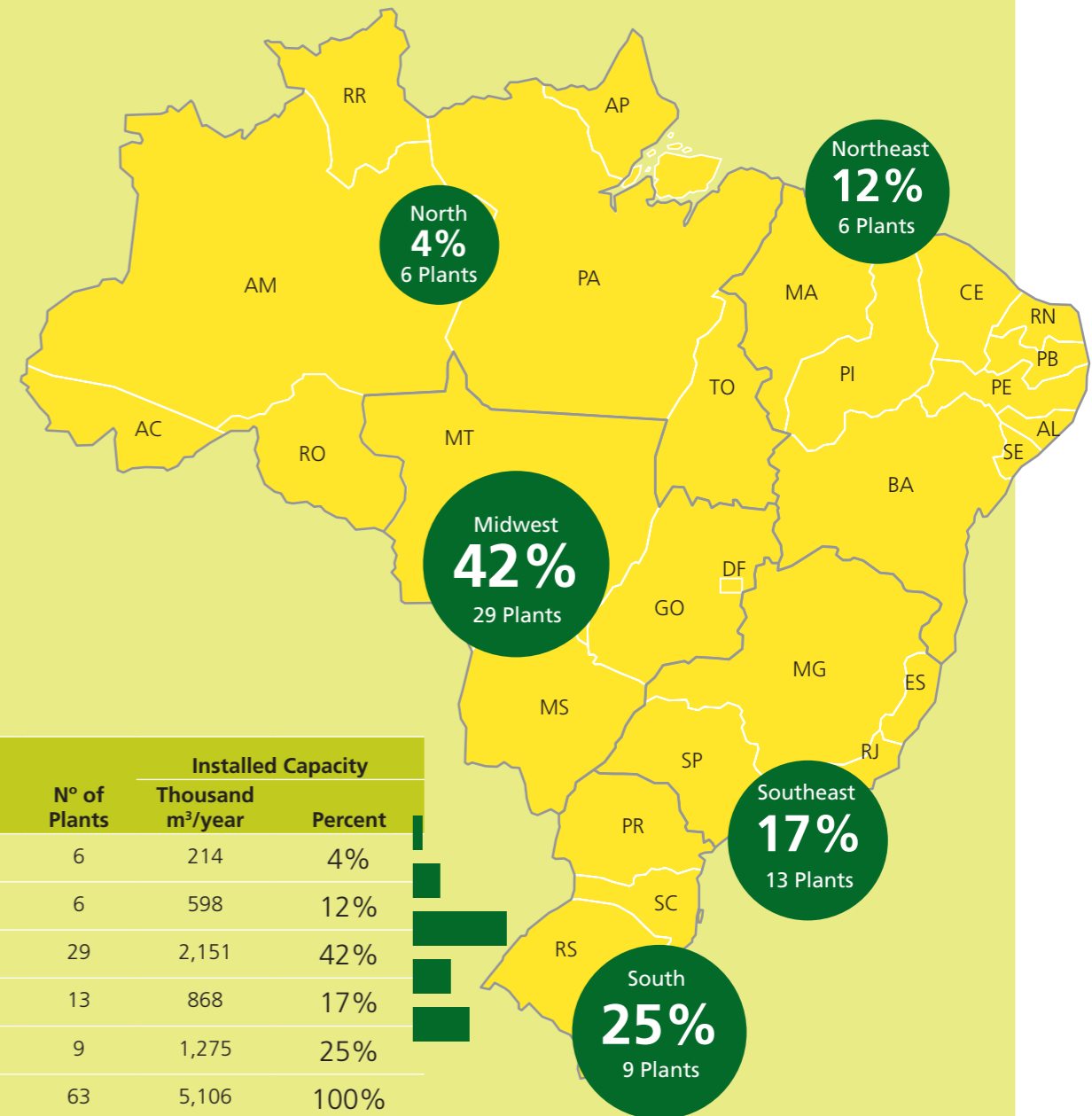
These investments were necessary to adapt the sector to producing volumes for B5. It is expected that, with higher goals, namely B20, for example, it is possible to have even greater investments, considering the need to develop new feedstock production bases.

The federal government played a key role in adapting the sector to produce larger volumes of biodiesel, by guaranteeing procurement and paying a given biodiesel volume to the plants through ANP public auctions. In the first auction the negotiated volume of biodiesel was 70,000 m³, earning R\$ 133 million, while in the last auction the 600,000 m³ of biodiesel negotiated earned R\$ 1.26 billion.

There is a noticeable trend to negotiate ever higher values as the mandatory mix of biodiesel to diesel increases. Another trend was the decrease in number of auctions as the mandatory biodiesel mix for diesel increases. This means that the production sector was becoming stronger since it was able to meet the growing demand in fewer negotiations, with ever increasing requirements of biodiesel mix in diesel, a reflection of the investments in that period.

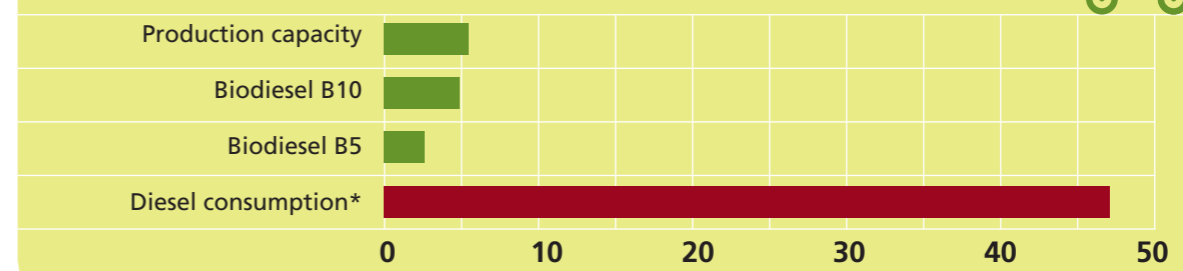
The early goal percentage blend of biodiesel in fossil diesel and will give viability to further investment in the productive chain

DISTRIBUTION BIODIESEL'S PRODUCTION PLANTS



Source: ANP, 2010, adapted by FGV Projects, 2010

* Production volumes in million m³



* Projection for the year 2010. Source: FGV Projects, 2010

As the market develops for higher mixes than B5, there is a strong upward business trend in the companies in the sector and also the arrival of newcomers to the market, principally in regions with feedstock production potential. This business logic inherent to the sector boosts development in the regions with a low human development index but with strong farming potential to supply the biodiesel industry; in other words, the investments are attracted by its oilseed production capacity rather than the local market's purchasing power.

Jobs created by the biodiesel industry's value chain are quite high in number in the farming sector, both in crops with a high mechanization rate, such as, for example, the soy chain, and in more labor intensive crops, better worked by family farming, as in the case of the castor oil plant and dendê. The biodiesel industry's contri-

bution is also relevant in relation to technological development, since it is an important vector for spreading know-how in the farming area where the search for competitive feedstock incentivizes the constant investment in new varieties and production techniques. In the industrial area personnel training for technical upgrade has been constant and important to maintain competitiveness in the companies in the sector, considering the medium-high market competition.

The biodiesel industry in Brazil has also been characterized by the participation of public and private agents, such as public agencies, plants, farmers, distributors, assembly lines, consumers and stakeholders that play a leading role in developing this sector. Embrapa (Brazilian company for agricultural and cattle farming research) plays an outstanding role and has been doing valuable

work in researching new raw materials with high oil yield, as well as developing the current oilseeds, namely, for example, the palm, in partnership with universities. These and many other projects are being carried out throughout Brazil, boosted by the PNPB.

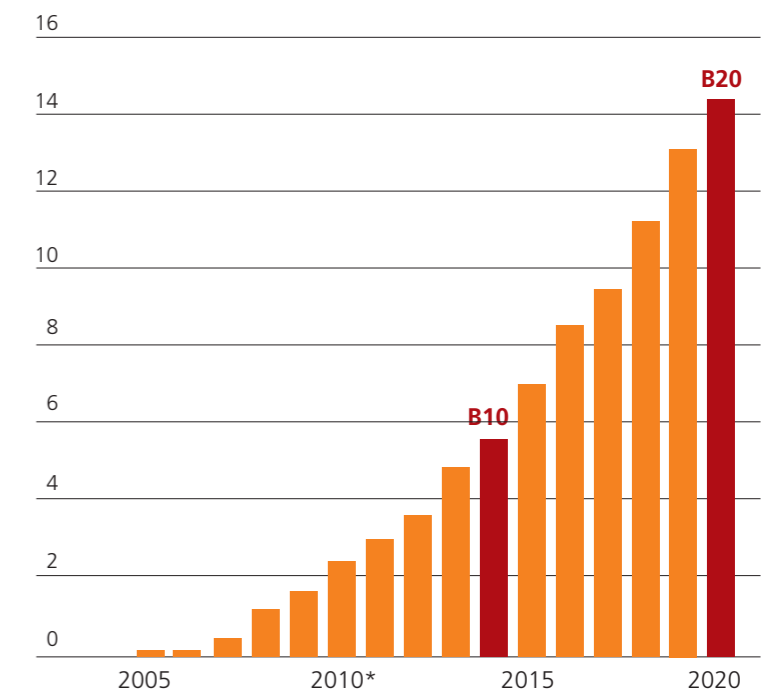
Between 2005 and 2010 the program was able to form a vigorous industrial base, with industrial capacity ready to meet demands for over B5. According to the Ten-year Plan for Energy Expansion announced in April 2010 by Empresa de Pesquisa Energética (EPE), for the current 5% biodiesel mix rate, the current production capacity of the biodiesel industry will be able to guarantee the supply by the year 2019.

A scenario of gradual increase in the biodiesel mix index, where the target is B20, for example, is extremely important for building the growth bases of the sector over the next 10 years. It is important to define a volume target for the forthcoming years to develop the production of every chain, mainly with regard to feedstock production, for which investments are always long term. The greater the predictability of the production volume for the next few years, the greater the structuring effect of investments will be; in other words, the clearer perception of return on investments and the fewer risks perceived by all stakeholders in the value chain.

These forecasts show that in 2014, the year of the FIFA Soccer World Cup in Brazil, the B10 mix will be achieved, with approximately 5.5 million m³ biodiesel, and may also advance the metropolitan B20. The major challenge for the biodiesel sector lies in building a favorable conjuncture for its expansion, preventing restraints to its growth and maintaining its virtuous trajectory. The success of the biodiesel program should not be regarded as an already assured result for the future. It is necessary to increase the current mix volumes to consolidate the confidence in growth capacity and maintain the sector's long term competitiveness. In short, the biodiesel industry has shown a supply capacity to cope not only with growing demand, preventing the formation of possible bottlenecks or inflationary pressures, but also capacity to absorb greater mix indices.

PROJECTED PRODUCTION OF BIODIESEL

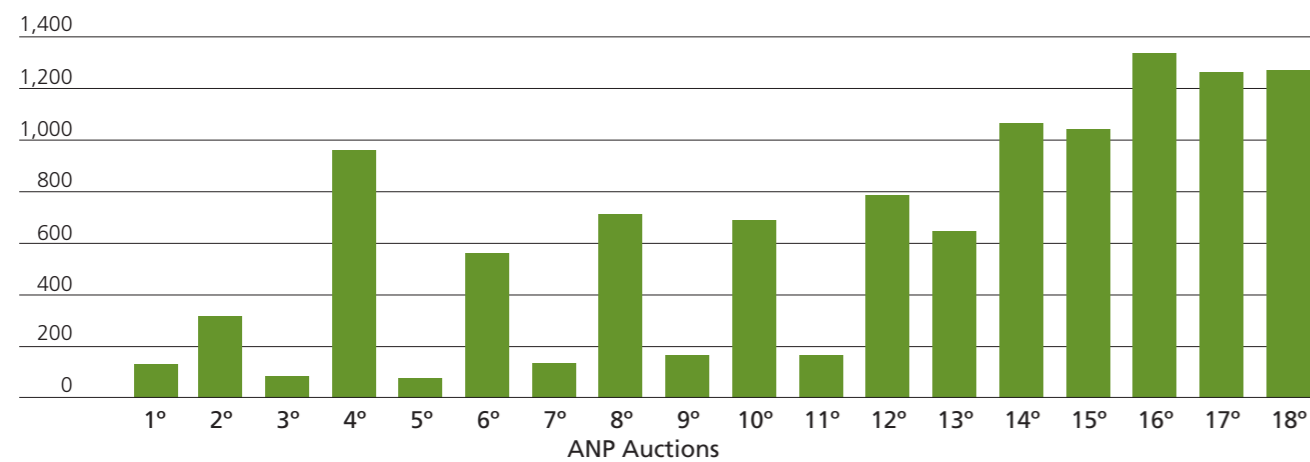
(million m³)



* Top of the projections. Source: FGV Projects, 2010

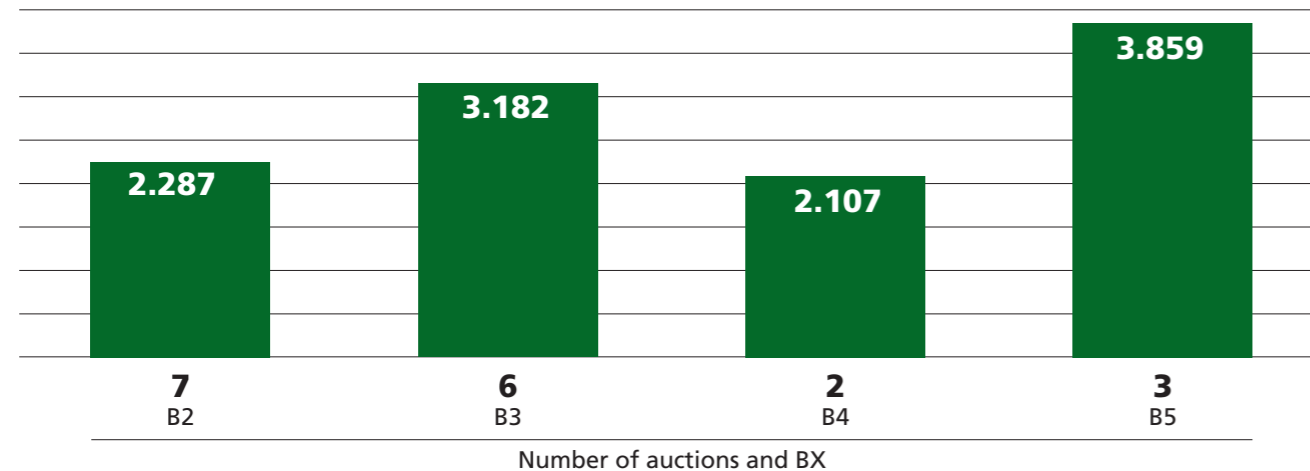
SECURITIES TRADED IN THE AUCTIONS OF ANP

(R\$ million)



Values and number of auctions according to the BX

(R\$ billion)



Source: ANP, adapted by FGV Projects, 2010

It is necessary to increase the current mix volumes to consolidate the confidence in growth capacity and maintain the sector's long term competitiveness.

Institutional effort to generate wealth and social inclusion

PNPB has furthered social inclusion and income generation in the countryside. The estimate is that approximately 100,000 families participate in the program throughout Brazil this year through the Social Fuel Seal.

Since its creation, one of the pillars of PNPB has been social inclusion through the Social Fuel Seal, granted by the Ministry of Agricultural Development (MDA) to biodiesel producers that procure feedstock from family farming and assure technical assistance and capacity building. To encourage biodiesel producers to adopt the seal, PNPB reduced the PIS/Cofins tax rates in accordance with different rates per region and have the sole right to participate in "lot one" (which represents 80% of the total volume) at ANP auctions. By using this mechanism PNPB has furthered social inclusion and income generation for family farmer communities and contributed significantly to encouraging diversification of feedstock production, in accordance with the farming vocation of the different regions.

This institutional effort to introduce family farming into the biodiesel production chain diversifies the oilseed production, including in the Brazilian agribusiness regions that once were on the edge of farming production and lacking development. In this context, the increase in the biodiesel mix in diesel to beyond the current 5% shall be a determining factor in consolidating family farming in the biodiesel value chain.

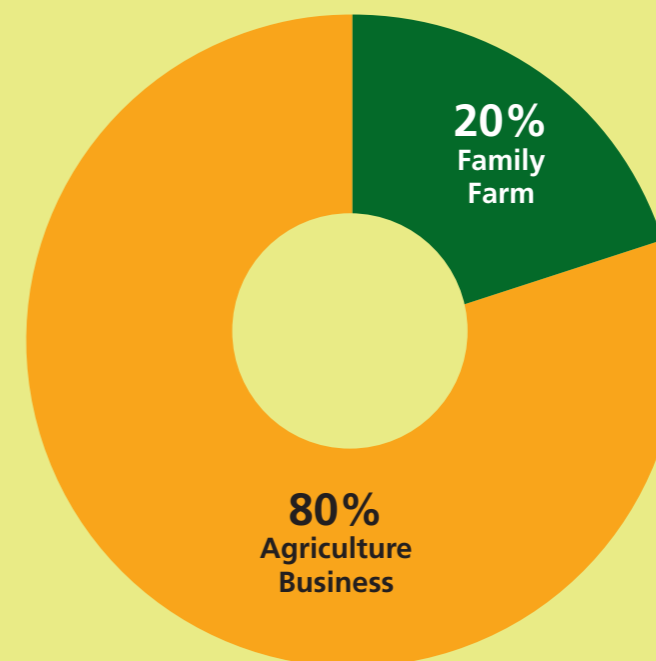
Biodiesel production was able to generate 1.3 million jobs, considering the entire production chain

Today 20% of biodiesel produced in the country comes from family farming and around 90% of this volume refers to soy cultivated by family farmers, mainly in South Brazil. Soy cropping in the family system employs one worker for every 10 ha, and in the business system one worker for every 100 ha. Considering this proportion with biodiesel production in Brazil, when calculating only soy production (1.6 million m3), around 100,000 jobs are created in the countryside. It is estimated that for each direct job in the countryside, 12 jobs are created in the agro-industrial production chain. In this case, biodiesel production from soy production alone would be responsible for around 1.3 million jobs, considering the entire chain involved.

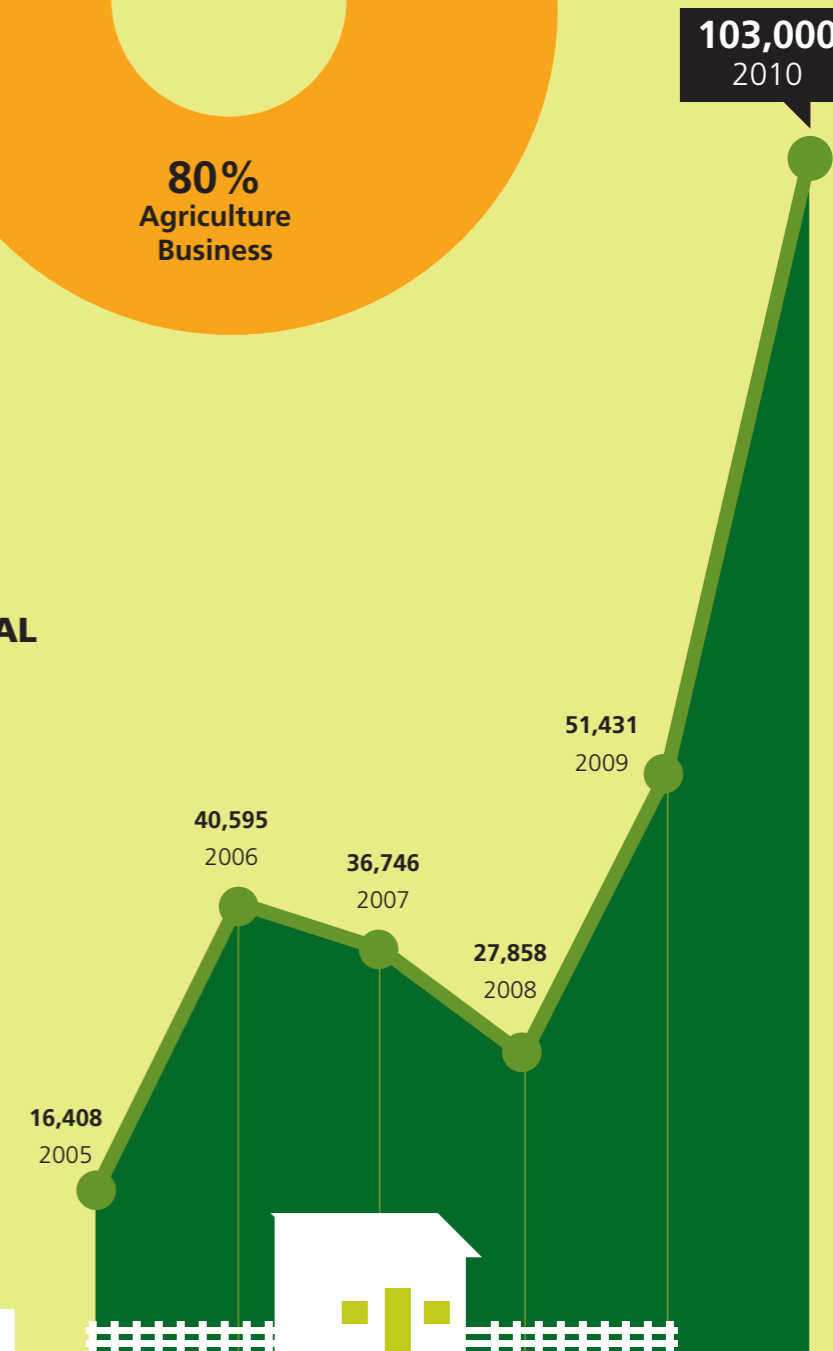
Feedstock diversification by introducing perennial crops may contribute considerably to creating new jobs, thereby contributing to regional development and generation of wealth.

Investments from Pronaf (National Program for Reinforcing Family Farming), run mainly by the Bank of Brazil in the scope of PNPB support lines, provided in 2008 alone R\$100 million for family farmers to produce oilseeds, at very favorable interest rates of around 1%-4% a year. For the inclusion of family farming in PNPB to be effective, other oilseed crops shall be included in the biodiesel production matrix. The main reason for including other oilseeds is to increase the family farming share. Soy will continue to be important for biodiesel, since it acts as ballast for the sector, giving the supply chain greater security.

PARTICIPATION OF FAMILY FARMING IN THE PRODUCTION OF RAW MATERIAL FOR BIODIESEL

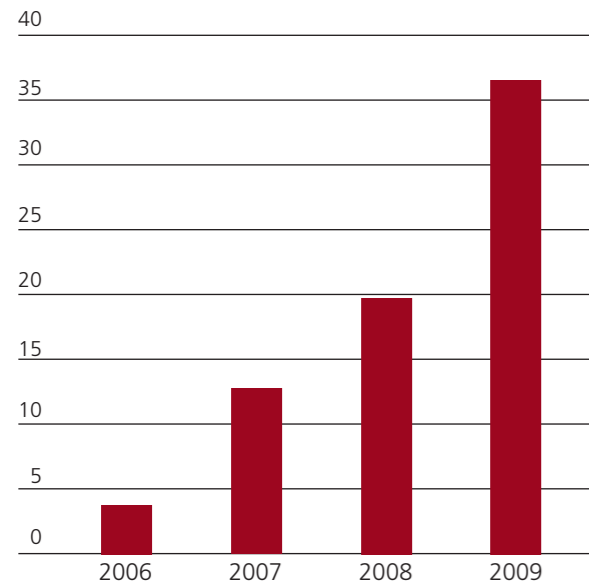


NUMBER OF HOUSEHOLDS THAT SUPPLY RAW MATERIAL



Source: SAF / MDA and FGV Projetos

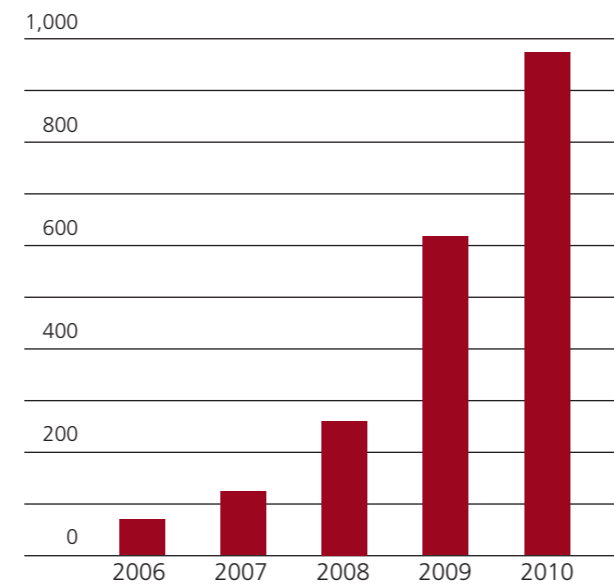
Cooperatives of small farmers who hold sales to companies with the Social Fuel Seal



Source: SAF/MDA, 2010

Purchases of raw material from family agriculture

(R\$ millions)



SOCIAL FUEL

For the biodiesel producer company to obtain the seal, there are minimum restrictions to procuring feedstock from family farming, specified in the Regulatory Instruction no. 1 dated February 19, 2009. The Instruction provides that from the 2010/11 harvest, the minimum limit for procuring feedstock from family farmers by the industry is 15% in North and Midwest Brazil. The minimum limit is 30% for South, Southeast, Northeast and semi-arid regions.

The percentages are calculated on the cost of procuring feedstock from family farmers or their cooperative in relation to the total cost of procurement of feedstock for biodiesel production. In

order for them to be considered in the percentage calculations, the farmers or cooperatives must have the DAP (Statement of Aptitude for Pronaf).

The values considered as feedstock procurement include not only expenses with the feedstock proper, but also expenditure with soil analyses on the family farms, sums referring to donation of inputs granted to family farmers (provided that they are not from public resources), and values referring to technical assistance and capacity building.

These factors are a major benefit for family farmers and biodiesel producers alike. Family farmers have guaranteed procurement for their production, in addition to technical assistance provided at no cost for best farming practices. An added benefit is for harvests in consortium, combining oilseed production with subsistence food production. Industrial biodiesel producers can allocate resources to training personnel, improving productivity in the areas where they procure feedstock, and even have this expense considered as part of their feedstock procurement. In some cases biodiesel plants not only provide technical assistance but also finance family farming by advancing seeds, machinery, and so on.

In June 2010, 31 of the 47 biodiesel production plants had the Social Fuel Seal, corresponding to 66% or 90% of installed capacity



In 2006 R\$ 69 million were spent on procuring feedstock from family farming compared to the R\$ 980 million predicted for 2010

Canola field

In 2009, 27 of the total 45 biodiesel producing companies had the Social Fuel Seal, corresponding to 60%. If the installed capacity in liters were considered, the percentage of installed capacity of seal-holding companies in relation to the total capacity would be even higher at over 90%. In June 2010, 31 of the 47 biodiesel production plants had the Social Fuel Seal, corresponding to 66%. Companies that have the social seal have exclusivity to participate in lot no. 1 at ANP auctions, plus tax benefits.

For the year 2010 the prospect is that around 100,000 family farmers are already participating in PNPB throughout Brazil. This prediction is an increase of practically 100% in relation to 2009. Currency spent on procuring feedstock from family farming has also been increased significantly. In 2006 R\$ 69 million

were spent on procuring feedstock from family farming compared to the R\$ 980 million predicted for 2010.

Less pollution and health problems in large cities

Adopting higher biodiesel mixes to fossil diesel will result in a significant reduction in hospital admissions for respiratory problems and would prevent almost two deaths a day in the six largest Brazilian capitals alone.

The large urban centers are the regions most affected by air pollution. Some emissions causing greater concern are particulates (PM), sulfur dioxide (SO₂), carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x), and emissions of photochemical oxidants, namely ozone (O₃). Biodiesel is one of the renewable fuels more beneficial than petroleum byproduct fuels. These pollutants are emitted in large quantities all over the country as a result of the predominant road transportation. Their effects are quite conspicuous in more densely populated towns.

Recently the Environmental Protection Agency (EPA) also acknowledged the potential of biodiesel to reduce pollutant emissions, calculating a 57% drop in CO₂ emissions in comparison with mineral diesel.

GREENHOUSE EFFECT

Burning fossil fuels is regarded as one of the main sources responsible for the greenhouse effect. Since it is a substance commonly found in nature, carbon dioxide is allocated to the unregulated waste group; in other words, it is inspected from the viewpoint of quantity and proportion launched into the atmosphere. It does, however, represent 64% of greenhouse gases.

Studies at the Federal University of Rio de Janeiro show that for the predicted Brazilian urban population growth in 2050, keeping the mobility

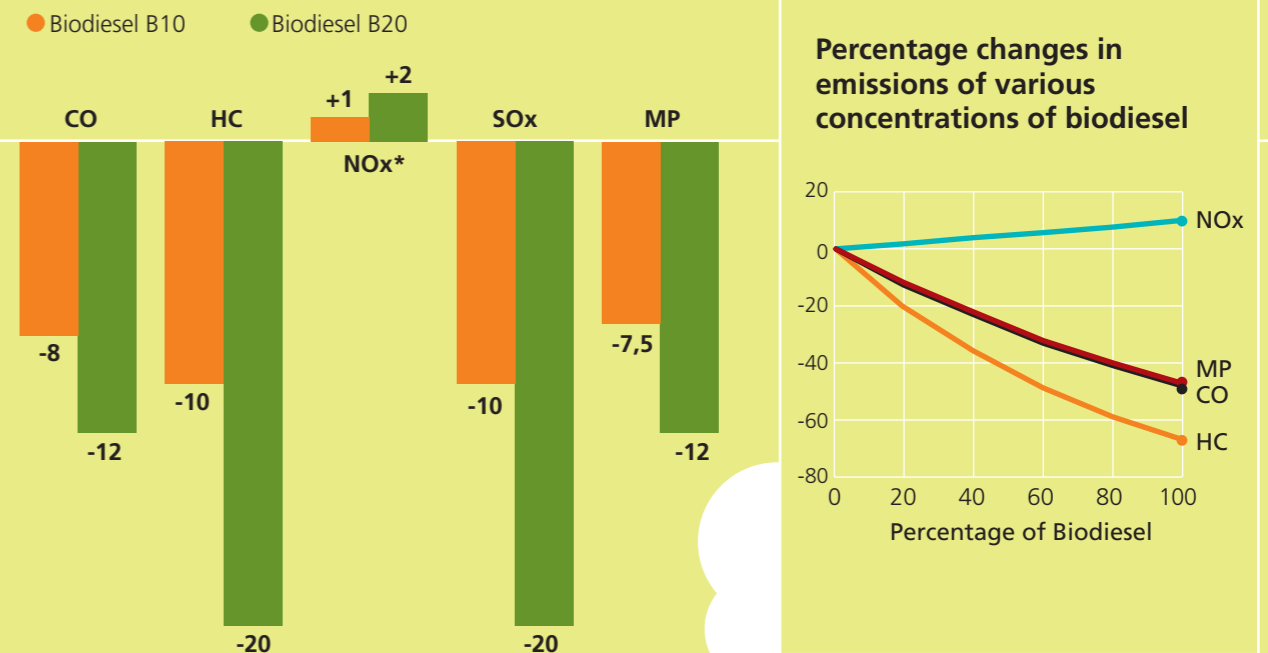
pattern prevailing today in Brazil, the estimate is an increase of more than 50% of all CO₂ emissions. A more significant increase of 590% is found when considering population growth combined with increased mobility. Even with population growth, but substituting fossil fuels for biofuels, there is a smaller increase of 165%. And, looking at the bright side, assuming population growth but maintaining the current Brazilian mobility pattern in the future and only substituting fossil fuels for biofuels, there is a 43% drop in emissions generated by the current situation. Substituting petroleum diesel for biodiesel may not only reduce the greenhouse effect but also offer monetary benefits in the world carbon market.

Analyses of the price series of the ton of CO₂ equivalent show an upward trend in the market price. However, the estimates considered the stagnant value of US\$10. From this conservative view, over a ten-year period with only B10, Brazil would generate approximately one billion dollars. With B20 this figure would be US\$ 2.9 billion. It should be mentioned that there is as yet no concrete definition of who would actually benefit from the credits, but in general the credits belong to the investor that, in this case, would be fleet owners running trucks fueled with the mix and thereby preventing CO₂ emissions.

Sulfur, one of the health and environmental hazards and present in diesel, is already targeted for actions to reduce it. In September 2009 the International Fuel Quality Center (IFQC) published a map showing countries that have diesel less

THE CONTRIBUTION OF BIODIESEL TO REDUCE EMISSIONS OF POLLUTANTS

Medium emissions (%) of biodiesel compared to fossil diesel



Pollutants from the burning of fossil diesel causing risks to the environment

Pollutants	Environmental Risks
Hydrocarbons (HC)	Form oxidants such as ozone (O ₃) and contribute to global warming.
Sulphur dioxide (SO ₂)	Main component of acid rain that causes corrosion of buildings and destruction of vegetation.
Carbon dioxide (CO ₂)	Main cause of the greenhouse effect.
Nitrogen oxides (NO _x)	Make up the acid rain in the form of nitric acid, compose the smog and contributes to the greenhouse effect.

Major pollutants from the burning of fossil diesel and its risks to public health

- Carbon monoxide (CO)**
 - Acts in the blood reduces its oxygenation.
 - It mainly affects the nervous system.
- Carbon dioxide (CO₂)**
 - Cause disturbances in breathing, sweating and headaches.
 - High levels can cause loss of consciousness or even death.
- Ozone (O₃)**
 - Damages lung tissue, reducing the resistance to infectious diseases.
 - Irritating to eyes and respiratory tract
- Nitrogen oxides (NO_x)**
 - Irritating bronchus and eyes, causing conjunctivitis, cough, asthma and bronchitis.
 - May result in pulmonary edema at high levels.
 - Responsible for the formation of photochemical smog.
- Hydrocarbons (HC)**
 - At high concentrations causes chronic poisoning, affecting kidney and liver.
 - At low concentrations causes headache, nausea and vomiting.
- Sulfur oxides (SO_x)**
 - Cause severe inflammation in the mucous membranes and respiratory tract and can be fatal in some cases.
- Particulate matter (PM)**
 - Aggravate allergies and bronchitis.
 - Generate discomfort, asthma, eye irritation and lung cancer.
- Volatile organic compounds (VOCs)**
 - Cause irritation to eyes, nose, skin and respiratory tract. Among the more critical are benzene and some aldehydes.

* The control can be done with catalysts and technological changes in engines.
Source: Morris et al., 2003, EPA - Environmental Protection Agency, FGV Projects

THE BENEFITS OF BIODIESEL IN HEALTH REASON FOR REDUCTION OF AIR POLLUTANTS

Admissions, deaths and costs resulting from pollution by burning of fossil diesel and selected capital in 2007

Capital	Hospitalizations	Costs (R\$)	Deaths
Belo Horizonte	4,078	4,521,933	579
Fortaleza	5,352	4,587,265	760
Brasília	4,332	2,745,502	615
Salvador	2,378	2,275,672	338
Rio de Janeiro	4,555	3,907,131	647
São Paulo	16,514	17,957,506	2,345
Total	37,209	R\$ 35,995,009	5,284 deaths

Source: FGV Projetos

harmful to the population's health, and those that still need to progress to reduce the sulfur content in the fuel. A survey by the IFQC rated 100 countries based on the sulfur limits in petroleum diesel. Brazil is ranked 68th. Amongst the so-called emerging countries, Brazil is behind India (56th) and South Africa (55th). In Latin America, it lags behind Chile (49th), Mexico (47th) and Costa Rica (64th)

To comply with the new legislative requirements, refineries will have to adopt new sulfur-reducing technologies for Brazilian diesel or even increase imports of diesel with lower content. Both scena-

It is estimated that 37,240 of all 133,000 hospital admissions for respiratory problems in the six largest capitals in Brazil in 2007 are caused by pollution from burning petroleum diesel.

Admissions, deaths and avoidable costs for selected capital in 2007

With the use of B10 Biodiesel

Capital	Avoided hospital.	Avoided costs (R\$)	Deaths avoided
Belo Horizonte	326	361,754.65	46
Fortaleza	428	366,981.22	61
Brasília	347	219,640.18	49
Salvador	190	182,053.74	27
Rio de Janeiro	364	312,570.49	52
São Paulo	1,321	1,436,600.45	188
Total	2,977	2,879,600.73	423

With the use of B20 Biodiesel

Capital	Avoided hospital.	Avoided costs (R\$)	Deaths avoided
Belo Horizonte	530	587,851.31	75
Fortaleza	696	596,344.48	99
Brasília	563	356,915.29	80
Salvador	309	295,837.32	44
Rio de Janeiro	592	507,927.04	84
São Paulo	2,147	2,334,475.74	305
Total	4,837	4,679,351.19	687

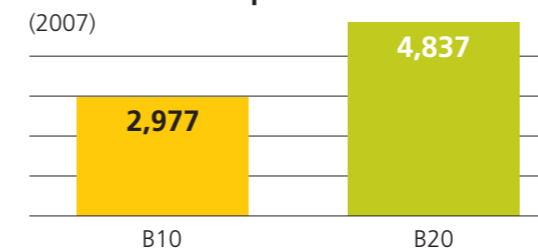
rios have economic disadvantages due mainly to the high installation cost and even a shaky trade balance. There would also be costs and impacts from the solid sulfur waste in hydrotreatment. The increased addition of biodiesel to diesel would reduce the sulfur content of the fuel, helping toward the efficiency of new engines.

PUBLIC HEALTH

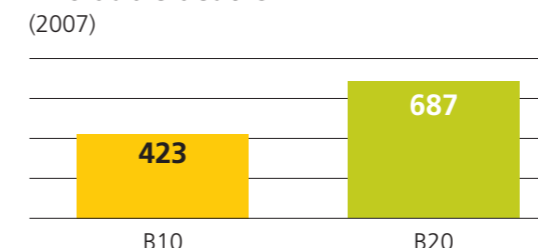
According to the World Health Organization (WHO), air pollution is said to be the cause of health problems and around two million early deaths per year worldwide.

The need to mitigate air pollution caused by burning fossil fuels is even more important when it is found that, in 2007, 133,000 hospital admissions were due to respiratory diseases in the six largest Brazilian capitals, resulting in 18,000 deaths (13.5%), and a total cost to the National Health System (SUS) of R\$ 128.55 million.

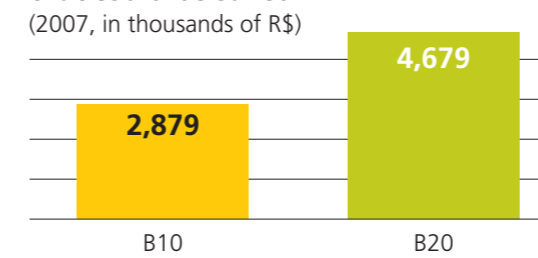
Preventable hospitalizations



Avoidable deaths



Financial resources that could be saved



These serious statistics are partly the result of air pollutants from burning diesel fuel, resulting in high concentrations of these substances in the six capitals in question. It is estimated that 37,240 of all 133,000 hospital admissions for respiratory problems in the six largest capitals in Brazil in 2007 are caused by pollution from burning petroleum diesel. Of these hospital admissions 5,284, or 14.20%, result in death, in line with the death rate of patients with respiratory diseases (13.5%), incurring costs of around R\$ 36 million for the public health system.

Accordingly, the reduction in use of mineral diesel fuel by increasing the biodiesel mixes by 10% and 20% could actually contribute to reducing the air emissions of pollutants harmful to human health, considering the smaller quantities of particulates (PM), carbon monoxide (CO), hydrocarbons (HC) and other pollutants present in biodiesel.

Taking the data on 37,209 hospital admissions, 5,284 deaths and R\$ 36 million spent on health due to the pollution caused by burning petroleum

diesel, the estimated impact of emissions prevented by adopting B10 and B20 mixes in terms of lives and resources saved. The adoption of larger biodiesel mixes in petroleum diesel would result in 3,000 and 4,800 fewer hospital admissions for respiratory problems, and prevent 420 and 690 deaths, for B10 and B20 respectively. Moreover, around R\$ 2.88 million for B10 and R\$ 4.68 million for B20 would no longer be spent on health. As the tables on the previous page show, the most polluted capitals, namely São Paulo, Fortaleza e Rio de Janeiro, would also benefit more from adopting B10 and B20.

In addition to the measured benefits, there are qualitative dimensions of the health and environmental benefits associated with increasing the biodiesel mixes in fossil diesel. Issues such as a better quality of life and urban landscape, for example, although hard to measure, are positive impacts on increasing the biodiesel share in the Brazilian energy matrix that cannot be overlooked.

The increased addition of biodiesel to diesel would reduce the sulfur content of the fuel, helping toward the efficiency of new engines.

Contribution to the trade balance without inflationary impact

With mix B10, Brazil practically no longer needs to import fossil diesel, which would improve the foreign trade result. Addition of biodiesel does not cause significant impact on inflation

Brazil has failed to spend from 2005 to July 2010, \$ 2.84 billion with imports of mineral diesel thanks to advances in biodiesel production.

The FGV-Ibre found an impact on consumer inflation between 0.00021 and 0.00034 percentage point a year - hence the projected increases in the participation of biodiesel blends will not cause significant impacts on inflation



Diesel is a key input for economy and its consumption is directly related to economic growth, as shown in the graph on the other page. In 2009, the national demand for mineral diesel was 44.7 million m³. Of this total Brazil imported a volume of 3.5 million m³, namely, 7.86% of the demand. The biodiesel production volume in 2009 was around 1.6 million m³, namely, approximately 3.6% of all diesel consumed in Brazil. To zero the country's diesel imports, the production of biodiesel would have to increase another 7.86% of all diesel consumed; in other words, with the B10 mix Brazil would practically no longer need to import mineral diesel, which would contribute against the current deficit resulting from the record diesel imports in the first half of 2010 (US\$ FOB 2.2 billion or 3.8 million m³ from January to June), with direct effects on the national balance of payment accounts.

Thus, based on the 2009 volumes, Brazil with the B10 would no longer spend approximately US\$ 1.67 billion, or 3.52 million m³ importing mineral diesel required to meet national demand. Not only would the trade balance be positively affected by the inclusion of B10 but the entire biodiesel value chain would benefit by increasing feedstock production that would increase consumption of farm inputs, technical assistance to the small farmer and family farming, storage capacity and oilseed processing, transportation, and so on. These activities together create multiplying effects on income, employment and tax collection in Brazil and contribute to a faster process of regional development.

PRESERVED PRICES

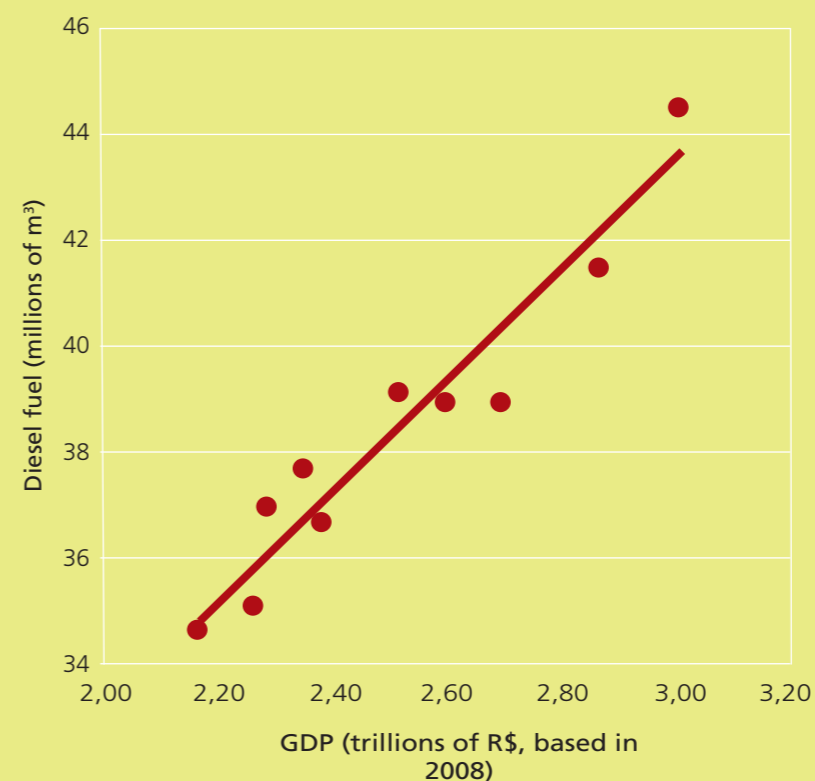
Taking 2005 as base year (start of the PNPB) and considering that all biodiesel produced since then has substituted a quantity of mineral diesel that would have been imported, the annual biodiesel production data can be compared with what was spent on mineral diesel imports (to calculate the average value spent per m³ mineral diesel each year), provided by ANP. From analyzing such data, it is concluded that Brazil stopped spending US\$ 2.84 billion from 2005 to July 2010 on mineral diesel imports, thanks to the progress in biodiesel production.

The **Ibre-FGV** study did not find any major impact on inflation as a result of the biodiesel addition to diesel. An impact was found on inflation to the consumer between 0.00021 and 0.00034 percent a year in the predictions of the B20 mix. Based on the figures given, it was concluded that the predicted increases of the share of biodiesel in the mix will not cause major direct impacts on inflation.

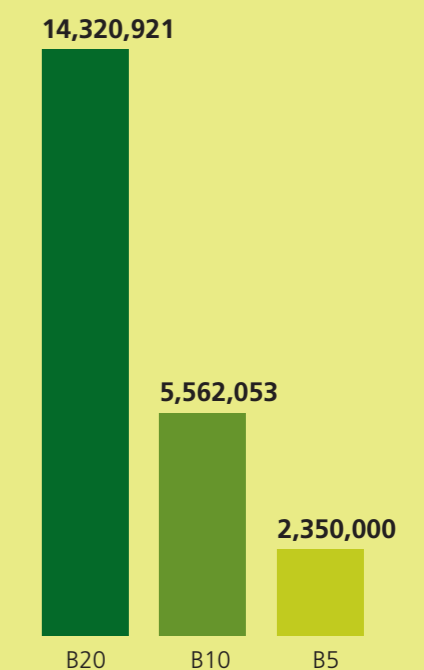
The following graph shows the biodiesel volumes that can be produced, predicting a B5 mix in 2010, B10 in 2014 and B20 in 2020. This volume gives an idea of the large quantity of mineral diesel no longer imported by increasing the biodiesel production to benefit the trade balance.

The mandatory nature of a mix to be established by a regulatory benchmark will act as a guarantee for supply and demand against crisis risks. Mention is also made of an upward trend in demand, based on Brazil's predicted economic growth over the next few years.

RELATIONSHIP BETWEEN GDP AND CONSUMPTION OF DIESEL OIL



Volumes of biodiesel produced considering different mixtures (m³)



Source: FGV Projetos

Valuable economic and social benefits for society

The country's challenge is to seize the opportunities of a favorable conjuncture to expand the biodiesel program. It is necessary to consolidate the confidence in the sector's growth and maintain its competitiveness

In this section, the forecasts referring to the increase in the biodiesel mix of 5% to 20% will be analyzed, based on the earlier sections. To do this, it is considered that Brazil will reach the B10 mix in 2014 and continue at an increasing rate in biodiesel production, having conditions to supply its fleet with a B20 mix by 2020.

With regard to feedstock, a sharp increase in oilseed production is predicted, including diversification of sources, expansion in cropping areas, job generation and distribution of wealth. As discussed, the relative share of soy in the total feedstock should drop slightly, as in the case of suet (beef tallow), while the share of other oilseeds should increase to meet the demand for these volumes.

In the case of soy, it was considered that Brazil will increase soybean crushing, exporting

a larger quantity of soy hulls, a product with a higher added value. Thus, in 2014 Brazil will have sufficient oil production to meet the predicted demand for B10 and a further area of only 1.62 million hectares of soy will be required in 2020 to meet the predicted demand for B20. This area is only 1.5% of the 106 million hectares available in Brazil for agriculture.

Considering a family production system, with one job for every ten hectares, it is concluded that 154,000 direct jobs will be created by adopting B10 in 2014, a total that will arrive at 531,000 jobs in 2020 with the B20. If the indirect jobs created along the chain were also considered, this figure will exceed six million jobs.

In relation to monetary circulation, there will be a potential R\$ 28 billion from investments and R\$ 23.6 billion from the sale of oil by 2020, distributed nationwide, mainly in currently less developed regions.

In relation to industry, a calculation can be made predicting the total additional investments required for an increase in the installed capacity, in order for the supply to meet the demand for B20 in 2020. It will be necessary to build another 9.2 million m³ a year of installed capacity, resulting in a total investment of around R\$ 7.36 billion over the next ten years.

Jobs will be created by adopting B10 in 2014, a total that will arrive at 531,000 jobs in 2020 with the B20. If the indirect jobs created along the chain were also considered, this figure will exceed six million jobs.

PROJECTED CAPACITY EXPANSION



Investments needed by 2020 **R\$ 7.36 billions**

LOOKING FOR A GENERATION OF JOBS TO THE ADOPTION OF B10 AND B20

Jobs created directly



EVEN MORE JOBS

With the adoption of B20 in 2020, will be generated

6 million indirect jobs



Volumes of oils and fats to attend the B10 and B20

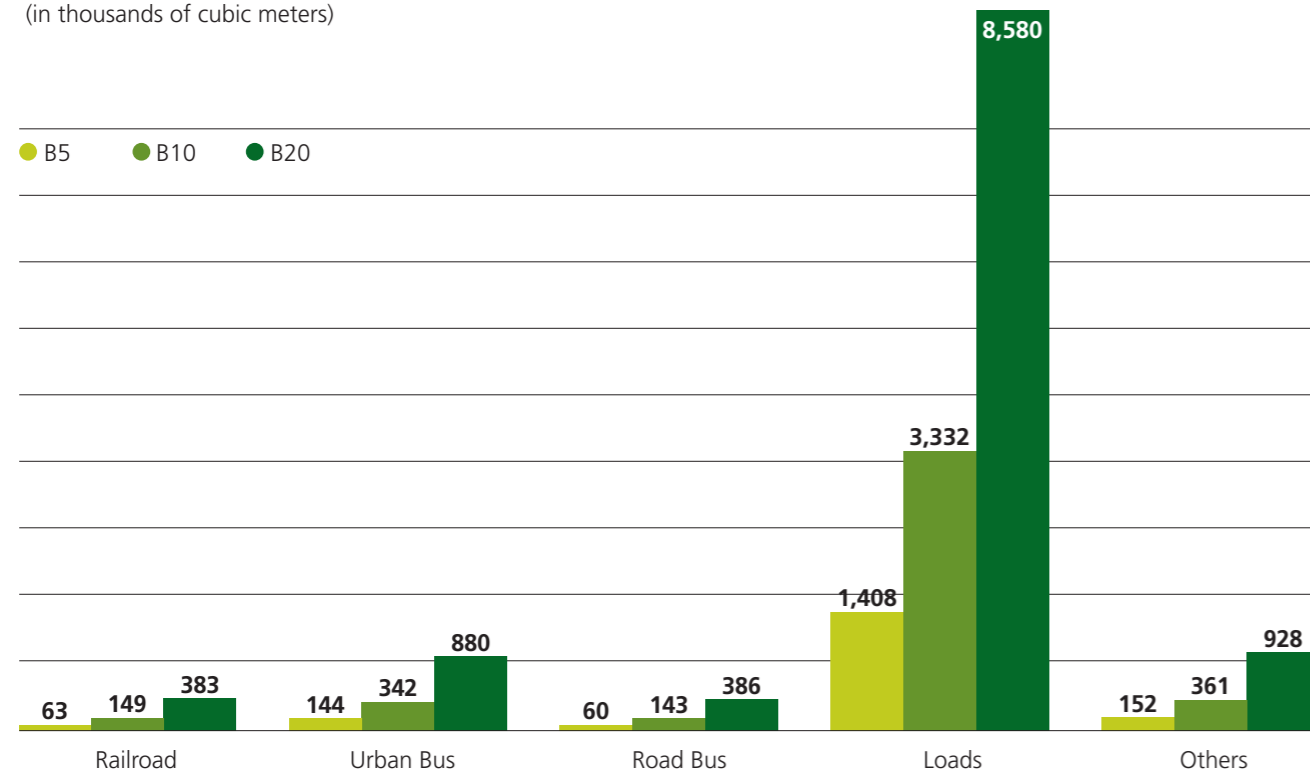
Oleaginous	Current	2014	2020
Soybean (1,000 m ³)	1,880	4,227	10,025
Tallow (1,000 m ³)	293	336	414
Cotton (1,000 m ³)	59	161	501
Others (1,000 m ³)	118	837	3,381

Source: FGV Projetos, 2010

MORE BIODIESEL, LESS EMISSION OF POLLUTANTS...

Projected consumption of biodiesel for transport subsector, in actuality, in 2014 and 2020

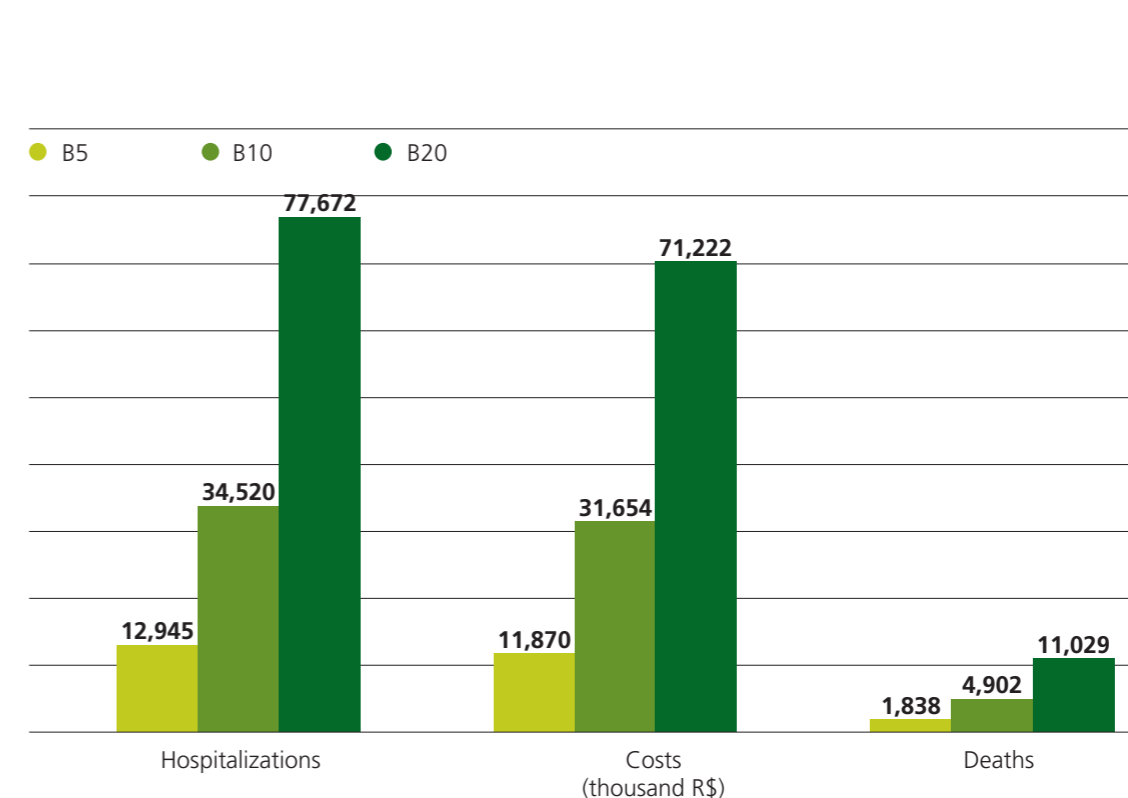
(in thousands of cubic meters)



Source: FGV Projetos, 2010

HEALTH COSTS LESS

Financial resources that can be saved and avoidable hospital admissions and deaths each year in Brazil



Source: FGV Projetos, 2010

With the B20, the number hospitalized for respiratory problems related to the combustion of diesel oil will suffer a significant reduction, with 77 000 admissions unless the country in 2020. In relation to the deaths resulting from pollutants emitted by diesel, it is estimated that there will be about 11 000 deaths less per year



As mentioned earlier, adopting increasingly larger mixes of biodiesel in fossil diesel has the potential to reduce pollutant emissions, with direct impacts on the number of hospital admissions, deaths from respiratory diseases and on spending by the public sector on health, considering six Brazilian capitals. It is found that B5 has already saved R\$ 11 million in public health, a figure that will steadily increase by adopting B10 and B20, the latter arriving at a saving of around R\$ 71 million. The number of hospital admissions due to respiratory disorders related to diesel fuel will also be significantly reduced, with 77,000 hospital admissions less for the year in 2020, in a B20 scenario. In relation to deaths from pollutant emissions from diesel, it is estimated that there will be around 11,000 fewer death per year in the country.

FINAL CONSIDERATIONS

The National Biodiesel Production and Use Program (PNPB) is a valuable opportunity for generating wealth and distributing income. Since its creation, the response from the productive sector has been enthusiastic - advancing the implementation of the mandatory B3, B4 and B5 mixes is the main example of its strength. The current installed capacity of around 5.1 million m³ a year would already meet the demand for an immediate B10 and would almost be enough to meet the increased demand by 2014. The benefits created by the PNPB are quite comprehensive and very often assessed from too narrow a viewpoint, not covering their full environmental, marketing, social and technological range, as predicted in the program's guidelines.

From the marketing viewpoint, soy must continue as an important alternative ballast to guarantee the supply of feedstock for biodiesel and assure the development of other oilseeds. On the world market, in accordance with the upward trend in animal protein consumption, there is elasticity for

Brazil to resume the 40% it held on the world soy hull market in 1996. This would represent exports of around 28 million tons of soy hulls and an income of US\$ 8.4 billion in 2020.

In the period 2005-2010, according to data compiled with the production sector, around R\$ 4 billion was invested in the biodiesel industry. Concerning mineral diesel imports, a B10 mix could meet this requirement, which would be a saving of US\$ 1.67 billion in 2009. Argentina, unlike Brazil, exports its biodiesel, which is currently more competitive than the Brazilian due to differences in taxation and conjuncture. These factors helped Argentina rank as the world's fifth biodiesel producer and increase this fuel's share in its energy matrix, with a current mandatory mix of 7% and a B10 mix planned by December 2010.

Increases in the mix to 10% and 20% (2014 and 2020 respectively) should not incur major rises in inflation (0.00021 and 0.00034 percent a year, as calculated by Ibre-FGV). Moreover, there



will be potential monetary circulation by 2020 of around R\$ 28 billion with investments and revenue that year of R\$ 23.6 billion from oil sales, which must be distributed throughout the country in the predicted scenario of feedstock diversification.

An interesting market strategy is to adopt biodiesel as a bottom price benchmark, guaranteeing the feedstock procurement in the event of a drop in the oilseed price, since the amounts spent in this procurement are taken into account when obtaining the Social Fuel Seal.

In the technological field, the PNPB shall be the main agent for developing various oilseed crops that have had little importance in national agribusiness so far. The scenarios studied in this article indicate progress in research and development of new varieties and crops, in addition to technical assistance and rural extension programs. The regulatory benchmark is essential for transforming research into productive arrangements.

Concerning the **environmental** question, today Brazil is known as one of the few countries in conditions to expand its farming production without major impacts on its biodiversity. Moreover, the adopting of higher biodiesel content mixed with fossil diesel represents a major reduction in pollutant emissions.

From the **social** viewpoint, decentralization and increase in oilseed production will be structuring factors for developing production bases,

even in currently less favorable regions, including family farming (settlements and traditional rural communities) and for preventing a rural exodus.

There is a plan to spend R\$ 980 million on procuring feedstock from family farming and for around 100,000 family farmers to participate in the PNPB in 2010, which would be double the participation in 2009. Also around 531,000 direct jobs are expected to be created by 2020.

With regard to public health, in 2007 133,000 hospital admissions for respiratory diseases were recorded in the six main Brazilian capitals, resulting in 18,000 deaths and a cost of R\$ 128.55 million. The adoption of a B10 mix would for this scenario result in 3,000 fewer hospital admissions and 420 fewer deaths, as well as a saving of R\$ 2.88 million. In the same conditions, the B20 mix would result in 4,800 fewer hospital admissions and 690 fewer deaths, and a saving of R\$ 4.68 million. In a scenario considering a B20 mix in 2020, around 11,000 deaths as a result of pollutant emissions from diesel would be prevented.

The National Biodiesel Production and Use Program (PNPB) is an innovative initiative, created in 2005 to encourage the production and use of this fuel in Brazil. Not only is it an alternative source of energy but also an opportunity to generate employment and income, with social, environmental benefits and for population health.

