

SOYBEAN OIL BIODIESEL PRODUCTION IN ARGENTINA CASE STUDY

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ABSTRACT: Soybean production is immersed within a productive system that cannot be analyzed on its own. A number of political and market factors, both nationally and internationally, explain the development and growth of soybean production throughout the globe. In the case of Argentina, the evolution of the agricultural system of soybean production has been characterized by continuous technological improvement. This has changed the whole agricultural system and set the base for societies growing demands for environmental and socially responsible goods. An advancement of regulatory context has allowed a better control of the future development of land usage. In Argentina's case the Law of minimum budget (Law on Conservation of Native Forest) is an example towards that direction. The Argentinean soy industry is one of the most dynamic economic sectors of the country, generating almost 30% of the external currencies income due to exports and representing almost 30% of GDP from the agro-industrial sector. Argentina is the world's leading exporter in soybean oil, soy meal and soy biodiesel and the third one in soybeans. The future expansion of this industry in the country is heavily dependent on internal and external changes in policies and is thus uncertain. A complete LCA study following EU procedures were performed. Several studies have been carried over in order to clearly calculate according to international methodologies the GHG emissions of Argentine biodiesel. Since the country has different agroecosystems and distances from the ports can be very different complete research studies were carried over on different regions of the country with respect to GHG emissions (Kg CO₂ eq/km), at a global level it could be said that the scenario that showed more GHG emissions was South East of Bs.As. (0,0447 Kg CO₂ eq/km). Comparatively and percentage with conventional diesel, its reductions of GHG emissions were of 75,5 %. Recent studies over very precise figures from farm to port on regional plants gave reduction percentages over 70 %..

Keywords: biofuel, biodiesel, agriculture, energy balance, policies, certification issues

1 INTRODUCTION

In Argentina, both stakeholders and territories address the challenge of renewable energy by producing fuels from plants byproducts, to reduce the emissions of greenhouse gases and the dependence on fossil fuels. A tendency to increase the biomass participation in energy balances is foreseeable for the coming years. Rapid growth was based on public policies that support this new business and technological and scientific strength, taking advantage of its competitiveness in soybean processes, Argentina has been quickly positioned among the leaders in the international markets for biodiesel.

It is very important to take in mind the dimensions and diversity of a country like Argentina that covers areas nearly tropical and in the other end Antarctic conditions through a distance north south of 3700 km and east west of 1300 km. The development of agriculture and biofuels feedstock's in the different parts face very specific conditions on the environmental technical and social aspects.

In the rich agricultural places of Argentina, a region industrialized since the 1940s by the development of the agro-food industries of corn, wheat, meat, cotton, sugarcane and soybean, mechanization is extended and metallurgical engineering serve the elaboration of agricultural products.

Biofuels derived from food crops co-products demands a specific treatment and study since conventional approaches developed for energy crops are not suitable to understand the Argentinean case.

Soybean production is immersed within a productive system that cannot be analyzed on its own. A number of political and market factors both nationally and internationally explain the development and growth of soybean production independently of biofuels production.

In the case of Argentina, the evolution of the

agricultural system of soybean production has been characterized by continuous technological improvement. This has changed the whole agricultural system and set the base for societies growing demands for environmental and socially responsible goods.

In terms of social and environmental aspects, institutions are crucial for the public and private sector. Argentina has developed an important and sophisticated network of institutions related to agriculture and agribusiness. A growing influence of several organizations has been significant. Just to name the most important ones: INTA, AACREA, PROSOJA and AAPRESID are mainly focused on primary production; while INTI, ACSOJA, MAIZAR, ASAGA, CARBIO & ABH more orientated to agroindustry and agribusiness. The growth of sustainable development awareness has been taking place in the whole agricultural system, with special emphasis in soybean production. This materializes in whole research done by the mentioned organizations.

There is also a parallel concern on social aspects coming from the public side (municipal, provincial and federal governments) and the private sector through new trends in enterprise management as fair trade, social enterprise, Corporate Social Responsibility (CSR) and sustainability certification schemes. The development of this trend has been institutionalized through the Social Responsibility Institute with specific tools to address this important issue (IARSE). There are important advances that have been reflected in concrete decisions such as:

- Criteria and indicator development
- Certified agriculture
- Certification biofuel schemes CARBIO, GBEP and RSB, amongst others
- Regulatory advances allowing a better accountability and management of land usage.

Technological development has allowed unquestionable improvements in the preservation of the environment. Just to name a few:

- Reduction of agrochemicals toxicity
- Application technologies (good agricultural practices)
- Direct seeding technology
- Precision agriculture
- Increment in unitary production that reduces the pressure due to utilization of new lands.

The advance of regulatory context has allowed a better control and the future development of land usage. In Argentina's case the Law of minimum budget is an example towards that direction. Over the last decades, soybean cultivation has had unprecedented growth. Since the 70's implanted areas have grown representing 37.000 hectares in the 1970/71 campaign to more than 17 million in the present.

The Argentinean soy industry is one of the more dynamic economic sectors of the country, generating almost 30% of the foreign currencies income from exports and representing almost 30% of gross domestic product (GDP) from the agro-industrial sector. The 2013/14 soybean harvest across the country predictions are over 53 million tones. Argentina is the leading exporter of soybean oil; production 7.5 million tons, with more than 5.2 million tones exported, which had an estimated value of more than \$4.3 billion before taxes. China and India are the main importers, purchasing more than 80% of Argentina's exports. Argentina is also the leading exporter of soy meal, with production estimated at more than 30 million tones, of which 29.5 million tones were exported, accounting for a value of more than \$10 billion before taxes (Ministry of Agriculture 2012). The EU imports nearly 40% of the soy meal exported by Argentina. At the later stage of soybean market expansion, producers started to create an added value product from the soybean supply chain - biodiesel. Argentina has quickly become the world-leading producer and exporter of soy biodiesel, with a production of more than 2.3 million tones (Jorge Hilbert 2012a).

Agricultural product commercialization is different from other goods, such as industrial ones, which determines the further organization of the industry as a whole:

- Production is spread over thousand of producers
- Most parts from agricultural products are harvested and placed in the market in the short term (seasonally). This means that the price tends to decrease during the harvest period and to increase once the stock becomes diminishing.
- For ecological and profitability reasons; production is concentrated on a regional basis
- Small number of internal demanders (exporters and processors). The participation of cereal brokers enables the concentration of the disperse stocks.
- Climatic factors are essential for the total production, and therefore also in the final price.
- With difference from most of the world's oil crop complexes such as rapeseed, Argentinean oil complex pays export taxes and in several cases also import rates in the destination markets.

- The fact that most of the production is export-oriented means that internal prices are highly influenced by international prices.

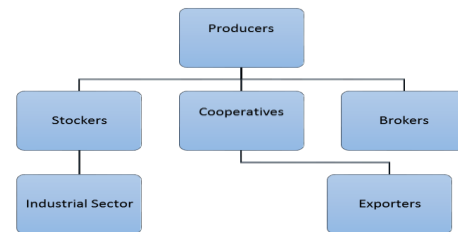


Figure 1. Actors in agro-products commercialization

In the (Fig 1) we can observe a summarized interaction between the different actors in the agricultural production. It does not have to be taken literally but for a general approach is a good reflection of how the Argentinean agro-sector is structured. The brokers are an important link in this whole system given that they can interact in the whole commercialization chain.. Its retribution consists of a variable commission. They also bring transparency to the whole operation given that they are grouped in a Stock exchange such as Rosario's.

Economies of scale and the efficiency of the soybean supply chain are exploited to make the Argentinean biodiesel a competitive product, despite the temporary increases in the biodiesel export tax from 14% (2008) to a variable rate of 24 % (2012) and reduced during 2014, to cope with increase import duties in the European market. Agriculture in Argentina is regulated with taxes being paid by the sector in different stages of the supply chain. The commerce is subject to export charges, primarily an export tax for biodiesel, with tax fluctuations according to the government's criteria also being the case with soybean

2 BIODIESEL SECTOR:

The Argentine biodiesel sector has grown based upon the well developed soybean production and transforming chain. Economies of scale and soybean supply chain efficiency were exploited and this made the Argentinean biodiesel a very competitive product in the international market. Increase in the biodiesel export tax from 20% (2008) to 32% (2012) and changes in EU markets severely threaten the industry. The estimated 2012 value of the biodiesel complex exports was around \$1.900 million. (Jorge Hilbert 2012a).

The refineries responsible for the principal market share of biodiesel are characterized by their high scale and efficiency. Most are located beside the processing complex and ports (Rosario city, Santa Fe Province), which lowers energy use and emissions. Raw materials typically come from a radius of 300 km or less, which also helps to increase efficiency. At a later stage of the biodiesel industrial development, small- and medium-sized enterprises started to be built in other regions. This type of production units receive a special price and share for the internal national market of 50,000 tones (2012 estimates)

Several large scale plants incorporate new facilities in order to produce higher value products such as glycerin. Large national companies (the oil manufacturers, General Deheza, Vicentin, and Eurnekian Citrusvil) and transnational corporations (Dreyfus, Glencore and

Bunge) built industrial plants with a capacity exceeding 225 million liters per year..

Installed capacity kept at a steady rate before new import restrictions were put in place by the EU in 2012, and export taxes were increased within the soybean biodiesel sector (Jorge Hilbert 2012a). Currently there are 26 biodiesel refineries authorized by the Department of Energy's Office, with an installed capacity close to 3,515,400 tones and 11 plants under construction with an aggregate capacity of 1,004,289 tones, making the projected installed capacity for 2013 an estimated amount of 4,575,189 tones (Hernán García Kairuz 2012).

The soybean biodiesel sector growth has been rapid over the last few years. The growth of installed capacity seems to back that assessment. The Argentinean biodiesel sector reach only 40 % of the capacity in the last months previous to recent changes in export tax revealing the enormous dependence of the business on local and foreign change of rules. Due to international demand for sustainable products, the Argentinean biodiesel industry has been working towards high efficiency, transforming the chain to low energy demand and a low carbon footprint and several deep studies were performed.

3 LAND USE

Law Number 26.331, Presupuestos Mínimos de Bosques Nativos (Native Forest Minimum Budget) was put approved in late 2007 and is an important step in land use planning through creating an adequate participatory territorial code. It is structured on the base of two central measures: one that strives to immediately stop deforestation, and the other producing an environmental territorial code for each province's land uses, including native forests. Its objective is to achieve conservation, sustainable forest use, and payment for ecosystem services, which are given to the local community. Thus, the code reflects the different conservation categories - I (red), II (yellow) and III (green) – which is linked to the environmental value of the different native forest units and environmental services provided. In February 2009, the National Executive Power dictated the Decree N° 91/2009 that implements the Native Forest Law. Unfortunately, this Decree did not adequately finance the National Fund for the Enrichments and Conservation of Native Forests, whose purpose is to contract for the payment of environmental services. (Di Paola 2012) This fund has yet to be adequately supported since then, raising serious concerns about the implementation of Law Number 26.331.

The Argentinean environmental planning process (Ordenamiento Ambiental del Territorio, or OAT) is an instrument of national environmental policy and management enshrined in the General Law of the Environment Number 25.675 of 2002. This is the set of technical, political and administrative actions including studies, proposals and adopted actions on the organization of a territory to suit the purposes of the policies and overall development objectives, including the Native Forest Law. This is a public function that is delegated to the territory in accordance with the general interest, determining powers and duties of land property rights under this target. The OAT requires strong citizen participation and involvement of various stakeholders and is consistent with the concept of sustainable development. It is worth noting that the OAT includes both terrestrial and aquatic territories, which should also

be the subject of strategic planning. Most of the provinces have already developed their maps classifying their territories

4 ENVIRONMENTAL CONCERNS – GREEN HOUSE SAVINGS

There are several aspects to be considered on the environmental subject. The case of soybean oil use is very particular since there is a need to develop a specific methodology in order to deal with a byproduct when the driver force of the crop comes from other sector.

In relation to emissions from the different stages the principal issues are

- Baseline subtraction
- Emission factor specially N2O
- How we can evaluate agric. systems with crop rotations and not single crops
- Land use change
- Indirect impacts

Sustainable agriculture in the country implies a virtuous circle integrating no-till farming, crop rotation, integrated pesticide/herbicide management, nutrient recuperation and rational use of agricultural machinery. This circle constitutes so-called Good Agricultural Practice (GAP). GAP increases productivity, conserves natural resources, contributes to carbon sequestration and natural nutrient replacement, and prevents soil exhaustion. Soybeans, as most *Leguminosae*, fix nitrogen from the atmosphere, thus reducing the use of artificial fertilizers, another source of GHG emissions.

Agriculture production is performed over a complex environment that already had certain emissions of GHG before human intervention. This is not very clear and little information is available. Another concern comes from the deep study of new extensive farming techniques as those applied in Argentina.

No-till farming techniques not only reduce GHG emissions because they promote year-round soil cover, no-till practices also minimize water losses from direct soil evaporation, (Fig 2) minimize residue disturbance and erosion losses, and favor biodiversity. This has a favorable impact on carbon and water footprint of the crop and enable farm production in areas, which had restrictions due to rain deficiencies or wind erosion risk.

There are concerns regarding lack of adequate crop rotation and nutrient replacement in certain areas of the country. With the growth of new processing plant of corn it is expected a growth of this crop in order to balance the actual rotations incorporating this high carbon crop



Fig 2 No until technology in Argentina

No till farming and precision agriculture has been growing steadily (Fig 3) in the last two decades. Behind this process there is a complex organization of engineers, consultants farm machinery factories, and governmental and farmers organizations

No-till area evolution as a percentage of the total agricultural area

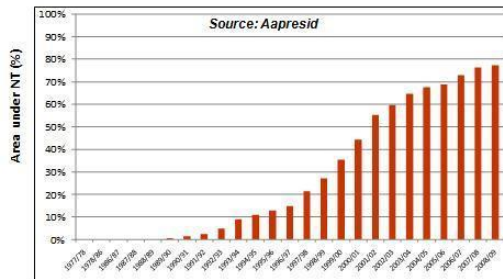


Fig 3 No till growth

Three recent studies by leading international research institutes and consultancies based in the UK, Germany and Argentina confirm that Argentine biodiesel produced from local soybean feedstock reduces greenhouse gas emissions by at least 56% compared to fossil fuels. These studies use the methodology for calculating biofuels' greenhouse gas savings laid down by the European Commission in Annex V of the RED. Studies focus on the energetic balances of each alternative; greenhouse gas emissions and global impact caused by the expansion of each feedstock used to produce these biofuels are being carried over by several agencies. During the last years, activity on this issue has been very intense, with different initiatives from the government as well as national and international institutes and organizations. Among them, we can mention the ones promoted by the European Commission, the Government of the United States, the Global Bioenergy Partnership (GBEP) and the Roundtable on Sustainable Biofuels (RSB). The Argentine case is very particular since as already explained a byproduct of soybean industrialization is used rather than the cultivation and promotion of a certain "energy crop". This oil by-product is turned into biodiesel. Due to the volume, future projections and export market towards the country's production is directed, it is very important to establish the environmental characteristics of the production in order to show the fulfilling of goals and regulations being created both in Europe and the United States markets. The objective of a new study carried over by INTA was to develop a tool (Fig 4) that could enable the calculation follow up and evaluation of improvement in the different stages of production of biodiesel and other products in an integrated plant placed in Frias in the province of Santiago del Estero. This case had special interest since it is not placed in the core of soybean and industrial process area in Santa Fe over the Parana River. Santiago del Estero is a lower income province and needs to increase its industrialization and generation of products that can enlarge the end value of products being produced and exported. For the calculations the 2006 IPCC directives for national GHG inventories, DIRECTIVE 2009/28/CE European Union Parliament and council April 23 2009, EB 50 – Executive MDL board "Guidelines on apportioning emissions from production processes between main product and co-and by-products" and

ACM0017 Methodology "Approved consolidated baseline and monitoring methodology Production of biodiesel for use as fuel" were used. The system covered the farm production of crops, short and long transport to the crushing facilities, all the industrial stages and the end transport to port and overseas. The data entered in the tool was provided by the company electronic database that runs under a SAP system were every step in the company is entered and can be verified and audited. The source of the raw material came primarily by own farms placed in the provinces of Salta, Tucuman and Santiago del Estero. The analysis and presentation of the results were divided into the different stages included in the overall process (farm production, freights of raw material, production of biodiesel and co products and final freight. The results were presented in three different ways according to how the final allocation of emissions was considered: energy content, mass balance and price of the different products and co products. The differences in numbers between the three alternatives reached a maximum of 20 %. The overall emission reduction of the integrated process reached a value of 73 % in Grs.CO₂eq/Mj well above the default value included in the European Union Directive. If the whole soybean biodiesel chain of Viluco is considered the total emissions reach 88.860 Tons de CO₂eq per year (including the industrial stage). Of the total emissions 69% belong to the industrial phase, 14% to the production in own farms, 13% from soybean purchased to other farmers and 4 % to transport and freights.

Emission calculator

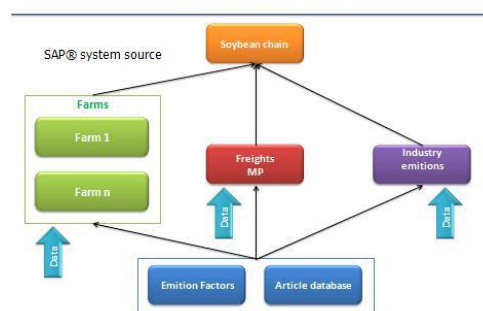


Fig 4 Developed system to evaluate the overall performance of the transforming chain

At the industrial stage, the emissions associated with energy use were responsible of 65 % and key input materials as methanol has a weight of 32 % in the overall analysis. With this and previous results of overall emissions by unit of product INTA performed a recent study to measure the impact of biodiesel use in the internal market and overseas, over the last four years a total reduction of 4 million tons was surpassed (Fig 5)

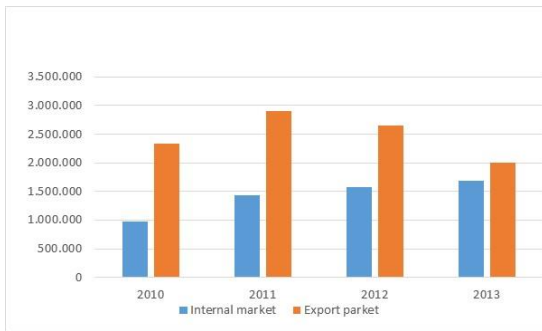


Figure 5 Emission reduction produced by biodiesel use in the domestic and external markets

Although there are still several uncertainties in the methodologies, there is strong work in progress in order to improve the estimation factors of the agricultural phase of production mainly looking at nitrogen oxide emissions and organic matter balance.

Although the final numbers are very important since they have relation to present regulations in the international market, the development of this type of tools is a key factor, in order to know better each step in the different processes and establish an improvement policy.

Presently this types of calculations are being performed during several years in order to take into consideration the climate and yield variability.

The 56-75% emissions savings range from the studies is significantly higher than the 'default' 31% saving fixed in the RED for soy biodiesel. The main reason for this is that the RED default value has been calculated assuming the typical pathway for biodiesel produced in Europe from Brazilian soybeans being imported as grains into Europe. Argentine soybean biodiesel production has three distinct characteristics compared with this benchmark, resulting in much lower greenhouse gas emissions:

Reduced local transport: In Argentina, distances between the main soy farming areas, the principal biodiesel plants and the main port export facilities are relatively short (300 Km. on average)

Lower biodiesel production emissions: Most Argentine biodiesel plants have lower greenhouse emissions from power generation compared with the value assumed in the EU-RED.

"No-till" farming: Argentine soybeans are typically cultivated using no-till techniques. No-till involves planting seeds without turning over the soil, using special drilling equipment capable of cutting through carbon rich surface crop residues. No-till techniques, properly applied under climatic and soil conditions typical of Argentine soy cultivation areas, can thus significantly reduce GHG emissions.

The importance of nitrogen oxide emissions in the agricultural sector is very big and the understanding and study of complex agro ecological systems is just in the beginning. Little knowledge is available and the degree of uncertainties is very big.

The last change in IPCC methodology for example (Fig 6) brings a great decrease in Argentina's agricultural emissions since nitrogen fixation plants as soybeans have an important role in soil emissions.

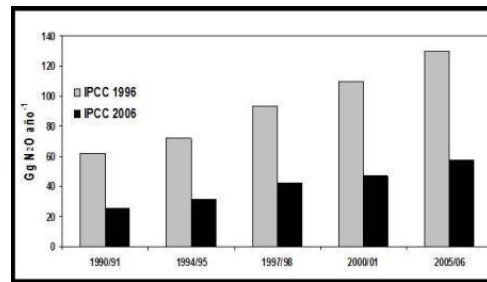


Figure 6 Impact of changes in the IPCC methodology over the Argentine agricultural sector

In order to increase knowledge in real agricultural systems INTA has specific projects looking at field measurements with different crop rotations, soil types and climate regions. At present measurements are performed over the base of sample chambers and eddy tower equipment has been introduced during 2012. A national network on field measurements has been implemented by the Ministry of Agriculture will enrich these studies.

Preliminary results indicate important differences between IPCC results and real measurements with lower values found in the field. There are also very important variations according to the rain distribution and soil condition of the soils.



Figure 6 INTA Field GHG measurements

Bioenergy/biofuels crops can not be separated from general agriculture and Argentina as one of the main actors in agricultural products has a long history on specific studies related to this issues. INTA has developed complex indicator systems to study and evaluate agricultural systems at a national, regional and farm level. The agroecoIndex is composed of several indicators that include energy, water mineral and biodiversity aspects of the production. The results are visually represented by a dashboard where the performance is represented by colors and indicators.

The biodiversity implications of land farming has been specifically addressed by an INTA project that is carried over by the Natural resource national research center. A specific program was developed that combines field and GOS follow-up information regarding birds populations and the effect of agrochemical use, risks and agricultural expansion in different territories.

The objectives followed by the program are

- ✓ Stop mortality of SWHA by removing the cause
- ✓ Develop partnership to act in a coordinated fashion between international and local actors
- ✓ Build wildlife ecotoxicology capacity in

- ✓ Argentina
- ✓ Start surveillance and monitoring program on pesticide impact on non-target species
- ✓ Orient farming community on the necessary changes in agricultural practices to reduce impacts
- ✓ Generate “products” for decision making

The precision agriculture has a long story, and is growing at a steady rate in Argentina. INTA has a special program to develop and promote this technology looking at the technical, economic and environmental benefits of its implementation by farmers. Research and testing is one of INTA's main priorities. INTA tests new technologies and tries to adapt them to the unique needs of Argentinean farmers and educate the farmers on the benefits of these technologies. One area that INTA has spent significant time on is precision farming. The group has tested and analyzed technologies such as yield monitoring, variable rate application, auto swath, and auto steer and, most recently, crop sensors. In recent years most of this type of equipment are being constructed in Argentina. This new technology lowers the agrochemical impact on the environment only using what is needed; other benefits are related with energy and carbon footprint.

5 CERTIFICATION

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Certification of biofuels is growing fast in Argentina. While there were, no companies certified as sustainable in 2010, by 2012, almost 30 certificates had been issued, with more to come. During 2011, approximately 50,000 tons of sustainable biodiesel were exported to the EU, which has increased since then. One of the main drivers for this growth has been a mandatory requirement being enforced in different European countries (Diaz-Chavez 2011).

In most cases, agricultural producers have certified their soybean production using the “book & claim” module. This procedure means that the producer will receive “credits” for the volume of certified soy, which can later on be traded independently from the beans.

Different schemes are already in place as RTES, ISCC and 2bsv

So far, one of the main drivers behind RTRS success has been soy meal buyers in Europe, especially The Netherlands. They would support the implementation and certification process and later on buy “credits” from them, without any physical transfer of product. On the other hand, there are companies that certified their chain of custody in accordance with the EU-RED Module in Argentina.

On the other hand, it should be taken into account that RTRS has a Progressive Entry procedure that allows farmers to plan implementation of systems requirement throughout the 5 year period that the certificate is valid. ISCC has been another implemented system. It should be noted that ISCC has a certain advantage over other certification systems due to the fact that it has been under operation for a longer period. The German Government officially approved it in January 2010, it was created to cover all types of biomass and biofuels (expanding its market to PME, SME, RME, sugar cane ethanol, etc.) and, more recently, and it officially recognizes certificates from other schemes approved by the European Commission. This means that, for example, an

oil mill may receive sustainable soybeans certified under RTRS or 2BSvs. Further, ISCC provides a comprehensible greenhouse gas emissions calculation methodology and establishes a period of three months for mass balance calculation. During this period, companies may have certain flexibility with their inventories, as long as by the end of the mass balance period, mass balance calculation shows that they have not sold more sustainable product than the amount of sustainable raw material they have received. Both these items contrast with requirements set forth by 2BSvs system. Another reason why this scheme might be expected to continue growing in the market is the fact that they have recently launched what they call “ISCC Plus”. The French scheme, **2BSvs** as it is commonly known due to the fact that it was developed by a French consortium has issued 471 certificates up to date; of which, 7 certificates belong to companies from Argentina. Most companies in Argentina obtain a certificate as a First Gathering Plant. Since this system does not necessarily require farm site audits for the time being, companies can demonstrate compliance with the sustainability requirements through carefully gathered documentation, satellite images, etc. In a way, this issue greatly facilitates the process of obtaining sustainable raw material. It is not possible to determine with this information, the volume of certified soybeans. Any company that obtained a 2BSvs certificate under Std. 01 may keep increasing the number of producers considered sustainable after the audit. The certificate acts as an “umbrella” and the audit consists of demonstration that the procedure outlined to include farmers and to assign them a risk factor complies with the requirements of the scheme. After this has been demonstrated, the FGP may continue to add new farmers to the group, always following the appropriate procedures. The analysis of companies certified under each scheme has shown, that several companies decided to show their support to one or more certification systems.

Being the oil fraction a small portion of soybean seeds (18 %) there is a need to certify great amounts of raw material in order to cover the whole biodiesel production. Little credit is obtained from this.

It is common ground for all schemes that sustainability certification actually starts at farm level. Without sustainable raw material, there is no sustainable product; and even though all certification schemes have traceability and GHG calculation requirements, the term “sustainable” is used for agricultural production.

The main requirement set forth in the RED and implemented by all schemes is to demonstrate that the land where the biomass is produced was under agricultural use before January 1st, 2008 (known as the cut-off date). Land use change from high biodiversity, high conservation value and high carbon stock areas is not allowed.

This is not a problem for Argentine producers, as main production area has been under agricultural production for decades and it can be easily certified through satellite images analysis. So far, this requirement is common to all schemes under use, so all farmers should have to demonstrate compliance.

Most of farm requirements are already included in local laws or even make for good management practices. However, authorities do not always facilitate implementation; farmers have to make an effort. From experience in implementation, it is possible to comply

with mentioned sustainability requirements.

The country lacks any proper waste management system for the agricultural sector. Although there are a number of legal initiatives under discussion

Record keeping is also dependent on culture. Practices range from a highly organized, precision farming oriented producer, to farmers that lack of appropriate documents to trace back all needed data...

Large groups of Argentine farmers are educated, participate in different agricultural associations and try to keep up to date with new practices and technology. However, when it comes to having proof of any training they participated in, certificates are scarce. Once again, importance is given to knowledge, but not always to formal records.

Argentine rules and regulations already establish that any transport of products has to be properly documented. In the case of grains for example, this is tightly regulated by the "Carta de Porte". This official document acts as a type of bill of lading, providing all information related to what type of product is being transported, the quantity, where is coming from and what the destination is.

Implementation of any sustainability scheme requires that specific information have to be included on said documents or, at least, the issuing of a document that complements the Carta de Porte or "Remito". Said information is related to sustainability characteristics, GHG emissions, relevant certification scheme and identification of "consignment" or sustainable "batch".

All of these issues are relevant because they affect the mass balance of sustainable and non sustainable biomass.

The use of mass balance is a great tool to avoid segregation, which would not be feasible for Argentina soy industry due to volumes handled. However, it is crucial to preserve its reliability to maintain a critical control point of incoming and outgoing sustainable product.

There are several initiatives on certification approaches being implemented in Argentina by different actors coming from the private and public sectors. An interesting approach has been developed by the Argentina association of no until farmers; it has a holistic approach of agricultural systems not concentrating the scheme on a particular crop. Certified Agriculture is a quality management system for the productive processes under No Tillage. It was designed to improve the business management and to optimize the resources-use efficiency. As a result, we obtain greater productivity within an environmentally friendly and energetically sustainable context. It is supported by a 20-year experience in No Till practice –a productive system based on the absence of soil tillage, on crop rotation and the coverage of the soil surface with crop residues. This procedure allows achieving a rational, sustainable and even reparative use of the agro-ecosystem basic resources like soil, water, air and biodiversity. The implementation of AC requires the fulfillment of a set of Good Agricultural Practices (GAP's). It also needs the registry of the agronomic management and the measurement of soil chemical and physical indicators for subsequent audits and the productive process certification. The implementation of "Agricultura certificada" is growing steadily since it was launched four years ago and reaching 100.000 has in different parts of the country

In conformity with Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009

on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (hereafter RED), the Argentine Biofuel Chamber CARBIO Sustainability Certification Scheme (hereafter CSCS) has been developed. The CSCS has been developed by the board of CARBIO, with the help of INTA. CARBIO is composed of the most important producers of soybean biodiesel in Argentina. CSCS covers the whole soybean biodiesel production chain, from soybean production to the biodiesel factories and transshipment points or ports. It has been designed to cover only the production of Argentine soybean biodiesel.

The CSCS has been developed to cover all the requirements stated in the above-mentioned Directive and related communications.

- Sustainability principles of the RED: GHG emission savings, protection of land with high biodiversity values and with high carbon stocks;
- Origin of the biomass;
- Mass balance;
- Independent verification;
- Auditable systems of each member of the CSCS.

GHG emission savings are calculated using the methodology stated in part C of Annex V of the RED. Under this Scheme, soybeans for biodiesel will only be produced on land which was under agricultural production before the 1st January 2008. Compliance with the aforementioned land related criteria and the origin of sustainable soybean is proved by using the Maps Methodology developed by INTA. Maps showing the Approved "Go" areas will be used. They are based on satellite images, soil charts, administrative land registers and site surveys. Maps identify minimum administrative regions, such as districts, and define as Approved "Go" Areas those that fulfill all RED requirements on land use related criteria. First Gathering Points or Conversion Units receiving soybeans directly from farmers will verify that soybeans come from Approved "Go" Areas using official transport documentation. If the origin of the soybeans is not properly defined, they will not be considered sustainable.

7 POLICIES

A vital point to be mentioned is that Argentina's soy biodiesel market as in the rest of the world is dependent on governmental policies. Mainly international markets, differences in export taxes and national mandatory blend requirements overseas that generated a new demand for this type of fuels have motivated the growth since 2007. There are different drivers and forces and multiple factors at a national and international level to be considered., The biofuel Law enacted in 2007 (Law 26.093), created a special regime for 15 years, establishing a 5% mandated percentage of biodiesel in diesel fuels. In order to increase this incrementally, the production incentives were enforced during 2010 and increased that same year to 7 % and during 2014 to 10 %. The reason for the government acting to stimulate biodiesel production was the need for alternative fuel options in order to change the increasing dependence upon imported fossil fuels. Oil dwells in Argentina are old and production went down in the last 10 years with an increasing demand due to high

economic growth of the country. The original law focused on the development of a domestic biofuels market, and it established a B5 and E5 requirement beginning January 1st, 2010. However, a global biofuels industry had already been launched by the time the law was enforced, and many large consumers such as Europe and the United States had already established ambitious targets. Although this framework is already in place, there are several administrative acts such as the update of the biodiesel reference price, which brings considerable turbulence when delays occur. The Legislative Branch's biofuels law gave the general basis on "what must be done in this matter"; the Executive Branch of government was responsible for its regulation or the how the law would be implemented although significant changes in this policy have been recently implemented during 2012/13 and 2014.

The 7% cut that soy biodiesel must have in diesel fuel generated an increasing demand towards soy biodiesel this blending was several times increased reaching 10 % from January 2014. In certain periods due to price actualization delays, it was more profitable to produce soy biodiesel and export it rather than only producing it to satisfy the internal demand. The Argentine private sector, led by the large oilseed crushers, saw a market opportunity and was among the first to build large biodiesel plants, typically using foreign technology, and focusing on export markets –which ended up being primarily in Europe. Argentina is, in fact, only one of the two countries that developed their export markets ahead of their domestic one driven by an abundance of feedstock, comparatively smaller domestic markets, and a desire to generate hard currency through exports.

The federal government created the National Biofuels Program and promoted the laws 26,190 that states that 8% electricity generation must come from renewable sources), regulating them and implemented policies aimed at the promotion and use of renewable energy sources, such as the "GENREN" program exclusively for power generation through renewable sources.

In 2001, Argentina introduced different policy measures in order to face one of the most serious economic crisis in its modern history. The government decided to introduce by Resolution 11/2002, export taxes in all products, with the objective to restore public revenues and to protect the most damaged social sectors in Argentina. The income taxes are used to expand and strengthen social programs for unemployment, food security and payment of external debts in due time. Those initial levels were lately increased at a different rate for several agricultural, oil and gas products.

An interesting point is the coexistence of two policies that seem contradictory. On one hand soy, biodiesel exports are affected by export taxes and on the other hand, production is promoted via the introduction of a quota for diesel fuel. In practice, export taxes as shown depreciate the end price received by farmers and cause a decrease in the expansion of the crop to new territories away from the central parts. In other hand, it promotes high efficiency methods in the primary production. Regarding differential export taxes (DET), the existence and extension of such measures are in close connection with tariff progressivity. When a raw material has zero or reduced import levy and the end product has a higher duty, in the middle, all the intermediate products have import duties in a scale and progressive level. From this perspective, at the beginning export taxes policy on

biodiesel did not work as an obstacle for the growth of the sector. The 2012/13 measures regarding a significant increase in export taxes over biodiesel, together with a decrease in the reference price paid in the internal market for the mandatory blend changed this new industry. As in the rest of the world, biodiesel is highly dependent on variable political decisions upon which the whole system depends.

Due to the importance of discussions with external markets on the Argentinian policies regarding the export tax on different products, mainly on the soybean supply chain, it is important to analyse those measures affected by the WTO standards and regulations.

- The use of export duties are considered compatible with WTO rules. GATT Article XI.1 states: "No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party". Export taxes are exempted due to the words "other than".
- Export duties are not considered a subsidy for production or export. There are legal precedents at WTO backing this interpretation like Canada - USA in timberland (WT/DS/194/R), particularly because the WTO Subsidy Agreement foresees to consider such practice if there is only a financial contribution from the government.
- Related to differential export taxes (DET), the existence and extensión of such measures is in closed connection with tariff progressivity, meaning that there can be a situation where a raw material has zero or reduced import levy and the end product has a higher duty, in the middle, all the intermediate products have import duties in a scale and progressive level.

At present, there is a high international controversy with actions being promoted against the EU and negotiations at the WTO.

The fact that several countries, especially the European Union established similar blending schemes as Argentina, opened up an attractive biodiesel export market. As a result, there was continuous investment in refineries for the production of biodiesel, even small and medium-sized ones. However, a few years later, in the middle of this year (2012), the EU position changed substantially. An EU Directive proposal came publicly available, amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Expressing the need to reduce biofuels from food crops, allegedly due to indirect land use change and due to the life cycle analysis overall GHGs emissions. This action, if it gets support will have an important impact on the industry. With the application of a tax of 22 or 26%, in addition to no longer receive the benefit of the General System of Preferences in Europe, the business situation of biodiesel will be difficult in 2014 The biodiesel industry Argentina does not have many options for support to the dumping duty imposed by the European Union (EU) . The sector now depend, at least two or three

years, the local domestic consumption through the cut with fossil fuels and have the ability to enter new markets, especially the U.S. The possibility of recovering the European place for Argentine companies for [biofuels](#) will remain uncertain for at least the next two years. All this precatory measures are strongly resisted at the international level since they are not base on science or evidence and they will surely bring more trouble into the market.

At the moment almost all intermediate associations are lobbying the national government at the various ministries and secretaries involved in internal policy management on the implementation of the Law and its implementing regulations. Examples are reports from the Argentinean Association of Biofuels and Hydrogen, Argentina Chamber of Biofuels and Companies House Energy and Biofuels SMEs.

Specifically these intermediate associations refer to internal policies, which establish the Joint Resolution of the Ministry of Economy and Public Finance, Industry and Federal Planning, Public Investment and Services No. 438/269/1001 dated August 7, 2012: The creation of "Interdisciplinary Executive Monitoring Unit" composed of several secretaries and ministries. This Unit, among other powers could determine the reference price for biodiesel. That price through Decree No. 1719/September 19, 2012 was determined by a formula calculating mobile export duties for biodiesel. In this way, the tax rate is equal to the Reference Price of biodiesel (PR) less total costs plus Return on Total Capital Employed (CRCTE), all in order to mitigate the effects of the drastic changes in international prices and avoid market distortions. This calculation is done on a biweekly formula using variables referenced. As well this determines the price of biodiesel for the domestic market, which should be equal to the reference price (PR) deducting the amount of the export tax, which is set at 23.63% now.

In the latest update by the Resolution of the Secretary of Energy N ° 1436/2012, intermediate associations mentioned above agree that there has been an economic imbalance that could reach the inability to continue the production of Biodiesel. During 2014 new, measures are being developed in order to increase the internal biodiesel market, one of them is related to the payment of taxes of biodiesel to be used for electricity generation. In this case, biodiesel will not pay taxes treating the fuel in the same way as imported diesel

The bill to amend the laws 23,966 and 26,028, through which exempts biodiesel until 31/12/2015 when intended for the electricity market in the 19% tax and 22% under the laws 23,966 and 26,028, respectively; and biodiesel in general tax of 19% provided for in the law 23,966 are in progress. With support from the president, the State places the biodiesel in the same terms with imported oil (which has exemptions from the law 19% of 23,966 and 22% of law 26.028), allowing the opening of the market for biodiesel generation electrical. This measure was required by the industry, not only by the inequality that had been generated with imported oil gas, but also by the huge decline that occurred in exports to Europe following the tariff measures adopted by the European Union .

The reduction to almost half the rate of export duty on biodiesel, lowering of 21.75% to 11%. This decision was adopted by the Interdisciplinary Monitoring Unit Executive (UEIM), after several steps of the export sector, with support from the Ministry of Federal Planning through the technical and economic justification

behind it. The measures were welcomed by the industry; however they claim that they should be substantive and not temporary."

8 CONCLUSIONS

The biodiesel industry has become a strategic sector in Argentina, contributing to a significant hard currency income through the complex (more than \$2000 million in 2012), important tax revenue from export taxes, and a decrease in the imported oil expense. The biodiesel industry has brought positive implications for the country: new investment; job creation; a cleaner, domestically sourced renewable energy source; and above all, one clear stride towards a path of sustainability and respect for environmental obligations. A major part of this success is because of Argentina's abundance of natural resources such as soybean. Argentina currently has an excess of soybean oil. No conflicts are presented regarding food/fuel tradeoffs since the industry is based on a food production co-product (animal feed), which has a lower dietary value according to modern medical recommendations.

9 FINAL REMARKS

As described Argentina as one of the most developed agriculture systems in the world is working on all aspects related to sustainability issues. This work is not only limited to biofuels production covering the completely agricultural production in the different agro ecosystems of the country.

Regarding the present trends in the world concerning biofuels production and based on the local long experience in agronomical studies certain aspects should be analyzed in order to improve the evaluation of biofuels:

- Need to differentiate three classes of feedstock's
 - Food crops were a byproduct is used for energy purposes
 - Mixed crops that can either go to energy or food
 - Energy crops with no other use
- Use of local information in each productive system with participation of local scientific experts
- Need to work with well-known crops or establish agronomical studies before reproducing wild plants as commercial crops
- In order to obtain positive results agronomical systems rather than particular crops must be addressed
- Need to increase research efforts in order to study and understand complex interactions between climate, soil, crop and agronomical techniques.
- All this concerns are critical when direct and indirect effects are forecasted.
- Policies must be orientated to agricultural products as a whole rather than a specific crop or use.

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