Biofuels: A Global Context And Viability in Mexico[1]

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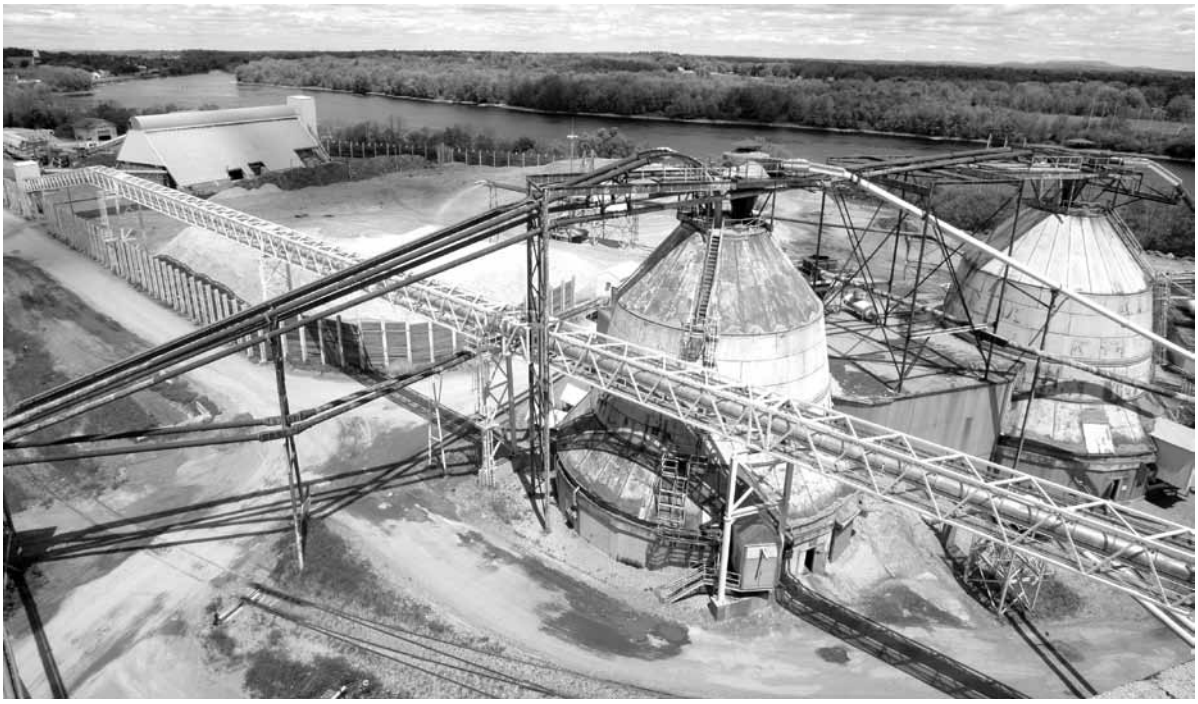

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Introduction

A CISAN research group is leading the "Public Policies on Biofuels in Mexico in the Framework of North America" project, and a related seminar, "North America, Climate Change, and Public Policies on Biofuels in Mexico," was held in September 2011, with the participation of key members of society, politicians, and business people working in this field.

To discuss the specific case of Mexico, federal legislators and government agencies, businesspeople, agricultural producers, scientists, and environmental civic organizations, as well as academic experts from various fields, all took part in the event. Biofuels have become an increasingly important topic, first, as an energy-related matter, since they are potential substitutes for fossil fuels; and secondly, because some argue that in the long term this technology could potentially reduce levels of energy dependency and greenhouse gas emissions, which would help mitigate the adverse environmental impacts that have been causing climate change.

The United States is the world's largest producer and consumer of biofuels and is competing to create advanced technologies such as second- and third-generation biofuels. Many countries, including Mexico, are in the process of deciding

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whether or not to adopt biofuel development programs. The decision will undoubtedly have significant long-term consequences for the country's national development.

Politically, the project of biofuel production has been seriously questioned as an agro-industrial proposal. The key players are clearly governments across the world: it has been proven that, without strong support and direct subsidies, biofuels are not commercially viable and not at all competitive in the alternative-energy market. Here, the exception is Brazil; yet Brazil's production model cannot be emulated as we will see below.

The demand for biofuels is based on new regulations for the composition of gasoline and other fuels in industrialized countries. Nevertheless, supplies are expected to come from developing countries. To this end, a biopact between the Northern and Southern Hemispheres was even fielded, whereby countries in the North would consume (not produce) biofuels and therefore keep their air clean, while those in the South would create rural jobs as well as suffer the negative environmental impact associated with the production of biofuels. Thus, an international market would be created and biofuels would become commodities, subject to the rules of international organizations, particularly the World Trade Organization (WTO).

Although biofuels have been known about for a long time, the cultivation of the raw material currently only occupies 14 million hectares, or between 1 and 2 percent of the Earth's arable land, although this percentage is expected to increase to 4 percent by 2030 and to 20 percent by 2050.[2] Technologically, biofuels must be seen as partial and temporary substitutes for fossil fuels and under no circumstance as final or definitive products, basically due to their low energy efficiency. In other words, biofuels represent solar energy received indirectly, and their photosynthesis is very inefficient since only 1 percent of the energy received by the plant can actually be used. It is estimated that they might work for around 30 years, until regular gasoline and diesel are no longer necessary, with today's vehicles being replaced by transportation that runs on electricity, solar power, hydrogen, or synthetic fuel. In the meantime, bioethanol and biodiesel are mixed with gasoline and diesel rather than used in their pure form. Therefore, biofuels are useful for artificially prolonging the era of gasoline and coal, since their use does not imply a change in the infrastructure for storing and distributing fossil-based gasoline and diesel.

Biofuels: Pros and Cons

Supporters of biofuel say that it offers a promising agribusiness opportunity within a production scheme in which everyone comes out a winner. Three well-known arguments are used to support biofuels: environmental protection, through reduced greenhouse gas emissions from transportation; energy security, given the dwindling reserves of conventional energy; and finally, rural development, especially in Southern Hemisphere countries, with the offer of jobs to large sectors of society or a revival of the countryside.

Unlike fossil fuels, biofuels were supposed to be carbon neutral. However, scientific evidence increasingly shows that these fuels, at least those currently available, do not in fact represent a drop in CO_2 emissions, and this casts doubt on the well-worn argument centering on environmental protection.[3]

There is widespread and far-reaching criticism of biofuels, or agrofuels, as many prefer to call them. Their production is believed to lead to known risks associated with single-crop cultivation, since it involves intensive farming operations occupying thousands of hectares of land, mainly in the Southern Hemisphere. Detractors argue that agrofuels mainly cause changes in land use, place constant pressure on natural forests, create tensions around resources like water, require intensive use of chemicals, and bring about radical changes in land-ownership relationships that are seriously damaging ecosystems and making it harder for poor peasants to access land, leading to socioeconomic difficulties.

From this perspective, agrofuels pose a threat to food production and sovereignty by intensifying the competition for arable land. There is disagreement on this point: global agroindustrial companies say that biofuels have only played a minor role in the recent spike in food prices. Smallholder organizations calculate that biofuels are responsible for at least 30 percent of the price increases. Those in the middle, such as the Food and Agriculture Organization (FAO) and independent research centers, tend to be ambivalent and waver between recognizing the potential benefit of biofuels and being con-

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cerned about their impact on people, food sovereignty, and the environment.

To face up to the risks associated with biofuels, their supporters' discourse has incorporated the terms "marginal" or "degraded lands" for planting of energy crops; however, these terms can be highly deceptive, creating confusion between the investment in and the colonization of lands in developing countries. In practice, producers with financial muscle use very high quality lands and possess other natural and technological resources such as water and developed infrastructure. The experience of the large producers, such as the U.S. or Brazil, seems to demonstrate that biofuel production needs large swathes of land, and also tends to concentrate even more the ownership of land and access to refining and distribution of the fuel.

The entire biofuel process is highly complex, ranging from the production of the raw material, the refining —i.e., the industrial process— and finally to the fuel's transportation or distribution. This characteristic seems to favor large companies, leaving small-scale producers little room for maneuver.

In short, the production of biofuels is a response to the scarcity of oil. Although these biofuels are not profitable at the moment, they prolong the lifespan of fossil energy because they do not affect the large production chains of cars or the distribution infrastructure of traditional fuels; but they are also a limited and temporary energy source. Criticism mainly zeros in on large-scale agroindustrial production since it competes with food production, while small-scale and local biofuel production, based on making the most of biological or agricultural waste as raw materials, is widely accepted by society.

The Debate

At the international seminar on biofuels mentioned at the beginning of this article, experts came from two of the large producing and consuming countries: the United States and Brazil, the country with the world's most sustainable biofuel project. We will therefore analyze both cases.

The U.S.: Who Benefits From Ethanol?

Sean Gillon, professor and researcher at the University of Wisconsin, presented a paper on ethanol produced from corn in Iowa, the largest producer of this grain and the region that boasts the production of one-third of U.S. ethanol and the largest number of production facilities.[4]

In the United States, ethanol production has grown almost constantly since 2002. This is explained by the existence of an institutional framework that has included federal mandates, such as the one requiring a production of 36 million gallons a year by 2022, distributed as follows: 16 million gallons produced from cellulose; 15 million from maize; and 5 million from other sources. To hit this target, a vast array of subsidies and incentives is available, mainly tax credits ranging from US$0.45/gallon available for blenders and US$0.54/gallon on the import tariff for unrefined oils or alcohols, to development funds from the Departments of Energy and Agriculture. This is in addition to decrees to reduce emissions or for the use of biofuels at a state and local level. Just like all biofuel projects, the United States' aims for the aforementioned three main objectives, on the basis of which Sean Gillon has made his critical assessment.

In terms of energy security, the group called Ethanol Promoters of America and army representatives claim that using ethanol instead of gasoline reduces revenues of "enemy" states such as Iran, and also helps prevent oil wars; however, the author argues that since the consumption of ethanol accounts for under 5 percent of the total fuel consumed by cars, energy dependency continues.

On agricultural development, Gillon states that previously most of the largest refineries were owned collectively by the smallholders. Today this has changed, and the largest refineries are owned by the largest companies. Although not a majority, these require larger areas of crops to be able to operate at 100-percent capacity, and therefore they compete with the collectively-owned plants for the best lands. The large multinational corporations in the sector, such as BP, Exxon, Chevron, and Conoco-Philips, as well as government agencies such as the Department of Agriculture (DOA) or the Department of Energy (DOE), offer research funding on biofuels

to universities. Many of these research projects are carried out in refineries owned by these large corporations.

Also, although it is true that biofuels have increased maize production between 2002 and 2010, and that the price per bushel of maize rose during that period from US$2.00 to almost US$6.00, smallholders have not reaped the benefits in terms of income; the costs of raw materials like fertilizer and land costs have risen at the same or an even higher rate than the cost of maize. Smallholders state that higher prices per bushel in fact earn them less profit than before. These conditions combine to put small- and medium-sized landowners at a disadvantage.

In terms of ecological impact, the Environmental Protection Agency (EPA) considers that the increase in energy crops would mean a step backward in land and water recovery achieved through the Farm Bill and the Clean Water Act. These programs focused on recovering land devastated by over-farming, rivers degraded by the use of fertilizers and pesticides, and spaces previously used for crops, with the idea of restoring them as nearly as possible to their original state. The production of biofuels would involve farming these lands once more, probably including intensive use of fertilizers.

In his conclusion, Sean Gillon states that, to meet the environmental objectives, apart from using biofuels, alternative policies would need to be explored: for example, alternative urban transport systems, such as the use of bicycles combined with some other type of efficient transport. The author firmly believes that policies to reduce fuel consumption and to make efficient use of energy would be more useful than the biofuels themselves. His research demonstrates that policies on reducing greenhouse gas emissions basically benefit the large, dominant players and minimize biofuels' other socio-environmental impacts.

Brazil: A Non-Export Model

Brazil's case was presented by Ricardo Abramovay, a researcher at the University of São Paulo, who argued that biofuels will play an important —but not the most important— role in decarbonizing energy used in transport (reducing CO_2 content and emissions). He pointed out that, in Brazil, biofuels are mainly obtained from sugarcane, and sugarcane ethanol is considered to have the world's most efficient energy balance.[5] Also, in Brazil sugarcane produces almost 9 000 l/ha, while maize only produces 4 000 l/ha.[6]

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Brazil's high levels of productivity are clearly the result of many decades' experience.[7] The positive results for Brazil in terms of profitability are also due to the existence of large landholdings, the single-crop *latifundios*, but since this poses the aforementioned risks, the country has worked on ways to mitigate them. This technological process has achieved four main successes: different varieties of plants are cultivated in order to diversify crops; insecticide and fertilizer use has been reduced by recycling residue; water is economized by not using irrigation; and waste is reutilized, thus reducing soil erosion.

Brazil has an automotive industry that, because of its large internal market, has enabled it to confidently respond to government decrees that demanded the gasoline-ethanol mixture. In this sense, the sale and production of what have come to be called *flex* cars (which can equally use gasoline, ethanol, or a mixture of both) now cover 80 percent of the Brazilian market, a high enough proportion to compete with oil products. And it is worth mentioning also that sugarcane, apart from being the raw material for ethanol, offers other benefits: it generates 25 percent of electricity; laborers working in the sugarcane plantations are the best paid; child labor has been eradicated; and now the sugarcane is cultivated with highly advanced technology.

Among the environmental impacts, Abramovay underscores the fact that the *finqueros*, or farmers, largely ignore the measures taken to protect biodiversity, and that it is very hard to ensure compliance. Bioethanol production also faces the problem of expensive raw materials, especially the petroleum-based fertilizers. To complement his analysis, he emphasizes the importance of other factors to improve the models of mobility in cities, which are still highly inefficient. It is illogical to use a car —a tool weighing 2 tons— to carry at most an average of 200 kilograms. Also, vehicular traffic increases the amount of time and fuel consumed per kilometer to the degree that some journeys take the same time for a person to drive as it would take him/her to walk.

Abramovay concludes that the factors that make ethanol production economically, socially, and environmentally viable in Brazil…are unique to Brazil. He therefore considers them unsuitable for export. Brazil has over 40 years' experience producing biofuels and this provides it with a skilled workforce for each and every process in the production chain; powerful economic interests are backing this type of initiative and the government does not face strong opposition to move forward with this technology. He concludes that every country wishing to adopt biofuels as an alternative energy source must consider first what it wants them for, and then, based on the answer, assess the different options.

Detractors argue that agrofuels cause changes in land use, leading to socioeconomic difficulties, and pose a threat to food production and sovereignty by intensifying the competition for arable land.

Biofuels: Viable in Mexico?

In 2008, Mexico's Congress approved a law to promote the use of biofuels, the Law to Foster and Develop Bio-energy. This piece of legislation arose in a context of the public's understanding and legislative debates about the possibility of allowing greater private sector investment in the state oil company, Pemex. Finally, and despite the fact that Pemex underwent a partial reform and was adapted to the new energy policy, the changes adopted in Mexico do not include any obligatory use of alternative energies; yet biofuels have still been promoted through government plans and programs at a federal and state level. For example, since 2009 the Ministry of Agriculture, Livestock, Rural Development, and Fisheries (Sagarpa) has run a program to support the sustainable production of raw materials for biofuels and for scientific and technological development (Proinbios); and that same year the Ministry of Energy (Sener) launched its own program to introduce biofuels. These programs have set voluntary targets and seek to replace the equivalent of 2 percent of the fuel consumed in Mexico's three largest cities (Monterrey, Guadalajara, and Mexico City's Federal District) with biofuels. Official programs in Mexico also have three objectives (outlined below), without any clear order of priority.

Energy Security. Mexico exports oil and imports gasoline. Therefore, the country faces the challenging prospect that its reserves, especially those easiest to access, are running out. Since 2005, Pemex's export capacity has declined due to its main deposits running out, and forecasts indicate that reserves will run out by 2020. Some experts point out that if Pemex were to make major investments in deepwater exploration technologies, it could resolve the issue of oil availability, although of course this would not be cheap oil. As a result, it is possible that Mexico will soon have to import oil and must therefore intensify its search for other sources of energy. However, it should be recalled that all renewable forms of energy, including biofuels, currently require subsidies. Mexico must decide where to place its bets on alternative energy for the future. To start with, the publicly stated unwillingness of Pemex, the principal link in the chain, to diversify energy sources seems to contradict all the calls for taking urgent measures.

Mexico still lacks any sizeable production of biofuels on a commercial scale. According to Sener, just 5 percent of energy consumed in Mexico comes from biomass, although this statistic mainly refers to the traditional use of bioenergy, in other words the burning of firewood in rural areas. Therefore, the introduction of biofuels in aviation and urban transportation has not yet reached a significant percentage in the energy balance of the transport sector, considered to be the main consumer of biofuel.

Rural Development. Mexico's biofuel law does not ensure direct subsidies for its production; instead, government support packages in this area are indirect: the Sagarpa-Conacyt programs provide funds for research on biofuels, and other programs provide seed capital for start-up biofuel businesses and to ensure project continuity. One of the broad rural-sector support programs includes a section supporting biofuel production. Sagarpa aims to create a market for raw materials and to train producers so that they can add value to their production. And some states, such as Chiapas and Veracruz, have offered incentives for cultivation.

In Mexico, the bio-energy law prohibits the use of maize for biofuels unless there is a surplus in national production, an unlikely scenario since Mexico imports a large part of the corn used for human consumption. Biofuels must therefore be obtained from other raw materials: from the jatropha, sugarcane, palm oil, agricultural waste, and algae.

Another specificity of Mexico is that almost 70 percent of farms are less than 5 hectares, due to a long tradition of micro-

Factors that make ethanol production viable in Brazil are unique to Brazil, which has been producing biofuels for over 40 years and has a skilled workforce for each process in the production chain.

holdings known as *ejidos*, which constitute most of the country's arable land. Mexico's landholding situation therefore contrasts starkly with that of the United States and Brazil, where large landholdings in the hands of single owners are the norm.

Finding a market for raw materials is another area of difficulty. In some cases, smallholders attracted by the incentive programs have made an effort to produce energy crops, but the lack of regulatory obligations has made it difficult for them to sell their product. This is a similar issue facing refiners seeking to sell their product: Pemex has not allowed biofuels to be refined utilizing its unused infrastructure, and although it has issued calls for tenders to purchase biofuels, no producers can sell at the prices offered. But if Pemex were to subsidize biofuels, it could offer a powerful stimulus for raw material production.

In the field of aviation, the federal government's decentralized Airports and Auxiliary Services Agency (ASA) is trying to create certainty of sales for biofuel producers through its "Flight Plan" project to promote the use of bio jet fuel. Its main stumbling block has been collecting enough vegetable oil, and the lack of technology has made it impossible for the refining process to be done in Mexico.

Reduction of Environmental Impact. Mexico produces 2 percent of global greenhouse gas emissions. Therefore, according to the Kyoto protocol, it is not obliged to cut emissions. Industrial activities and transport are the principal consumers of energy; urban transport emits the most greenhouse gases. There is disagreement over whether biofuels could resolve the environmental problem without creating another bigger one. Most of Mexico's energy crops are concentrated in areas of high biodiversity, like the states of Chiapas and Veracruz, where jatropha and oil palms are grown.

To reduce environmental impact, a series of experiments are being undertaken with other crops: in this phase, scientific research is looking at how to create biofuels from cellulose extracted from waste plant material from the agave, banana trees, grape vines, olive trees, fast-growing grasses, and algae. This type of second-generation technologies still requires a few more years and significant resources to be developed. In any case, environmental assessments must ensure that the proliferation of energy crops does not damage biodiversity or contribute to deforestation.

In conclusion, of the three objectives that it is hoped biofuel policies will achieve, rural development may be the most important. Mexico lacks experience in mass biofuel production, while international competition intensifies, with countries in Asia, Africa, and Latin America interested in producing biofuels for export to industrialized countries. VM

Notes

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[2] Ben White and Anirban Dasgupta, "Agrofuels capitalism: a view from political economy," *The Journal of Peasant Studies* no. 4, vol. 37, 2010.

[3] M. Hartmut, "Con los biocombustibles no se ahorran emisiones de CO_2," *El país*, September 12, 2007.

[4] Sean Gillon, "Fields of dreams: negotiating an ethanol agenda in the Midwest United States," *The Journal of Peasant Studies* no. 4, vol. 37, 2010, pp. 723-748.

[5] Energy balance is defined as the ratio between the amount of energy required to obtain an amount of biofuel and the amount of energy that this quantity of biofuel can generate.

[6] Ricardo Abramovay, comp., *Biocombustíveis. A energia da controvérsia* (São Paulo: Senac, 2009).

[7] For example, in 1970, 3 000 l/ha were produced, and in 2010, 7 000 l/ha.