Bioeconomy and Production Development

IICA

The geopolitical importance of the agriculture sector for energy security

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Introduction

Oil has historically been a key component of the *"energy security"* of countries. However, following the dissolution of the Soviet Union, the notion of oil gradually changed from a "strategic good" to a commodity, based on the understanding that oil could be acquired in the same way as any other raw material, and that it would always be supplied at prices determined by the market.

The debate between *"strategic good"* and commodity was never fully resolved. The latter notion was occasionally challenged during specific events that temporarily raised the price of crude oil. In fact, this debate tends to gain greater relevance during wars, despite the fact that these events impact oil supply rather than prices.

Compared to previous conflicts, the war between Russia and Ukraine has distinct characteristics that have led to a resurgence of the concept of energy security, which was never fully abandoned. First, because Russia is Europe's primary supplier of Natural Gas (NG). Although NG is undergoing a "commoditization" process (not yet completed) through the technological incorporation of Liquefied Natural Gas (LNG), which is gas that has been cooled down to liquid form for ease of transport in LNG tankers, it is impossible for Russian gas to be replaced by LNG given current infrastructure.

This situation has already had an impact not only on Europe, but worldwide, with the price of LNG rising sixfold over the past month. The rise in prices, however, is not the only issue; supply shortages are expected to be the greatest drawback. Europe's new demand for LNG, as it attempts to make up for the lack of Russian gas, will result in an insufficient supply to meet global needs.

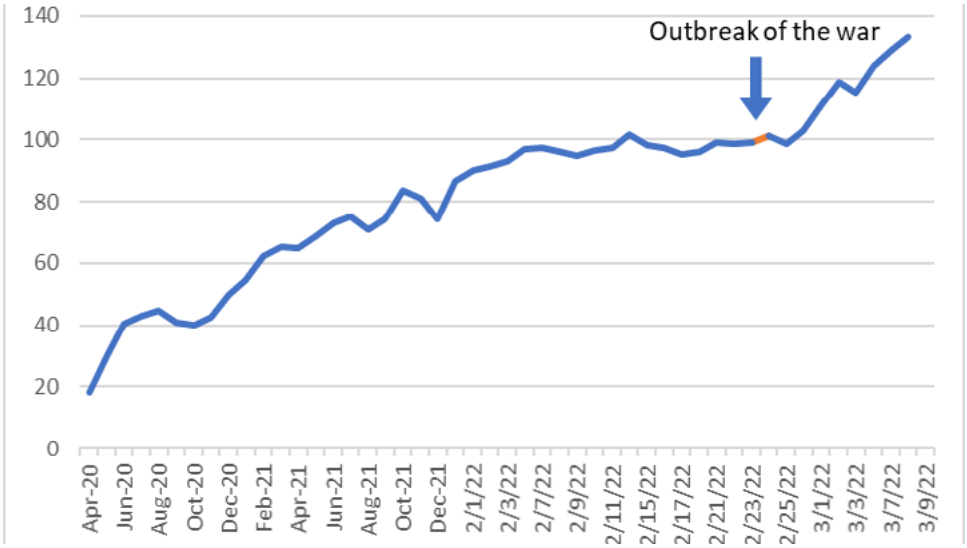
Recent sanctions by the United States and other countries involve banning the import of oil from Russia, causing issues similar to those related to natural gas. Russia is among the three largest oil producers in the world (along with the United States and Saudi Arabia), accounting for 12% of the total crude oil supply. These sanctions, as well as the country's financial isolation, are causing a substantial increase in oil and natural gas prices. The combination of these circumstances could result in oil shortages and, in turn, a supply crisis for the first time in more than three decades.

In light of this situation, and given their high market penetration at the moment, biofuels, and liquid biofuels in particular, are gaining strategic importance given their capacity to meet part of the demand for oil and oil derivatives. In this regard, the agriculture sector in the Americas emerges as a sector that not only contributes to guaranteeing food security, but also to strengthening energy security.

Recent impacts on oil prices and current situation in the Americas

In April 2020, with the pandemic in full swing, the price of oil dipped to negative values for a few days[1], as a result of the sharp drop in consumption due to movement restrictions. As demand began to increase, the price of oil began to recover; by December 2021, the average price of Brent oil was 74 dollars per barrel. However, tensions between Russia and Ukraine caused an upward trend in the price of crude oil, which increased considerably on February 24, when the war began. Over the course of just 9 business roundtables, the price rose 34% compared to the price before the invasion, and 625% compared to the minimum listed price for April 2020.

Figure 1: Price of Brent oil in dollars, per barrel



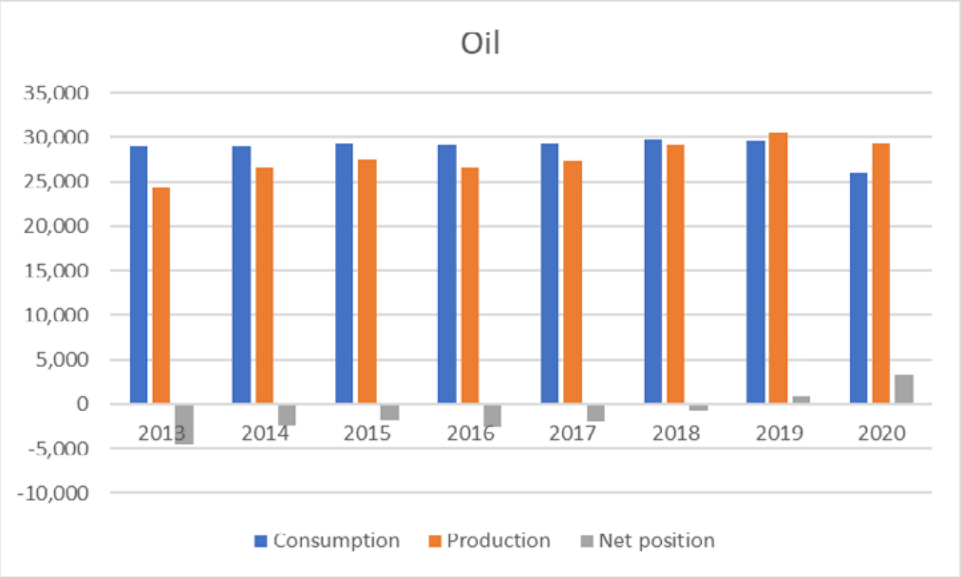
Source: Prepared by the author based on EIA (2022) and Datos Macro (2022)

In addition to the sharp increase in the price of oil, and, in turn, of all its derivatives, we now face the possibility that the measures applied to Russia could generate a supply crisis.

Against this backdrop, the Americas is unique in that it has been able to reverse its historical position as a net importer of oil, particularly due to the strong increase in non-conventional oil production in the United States and Canada, as well as higher production in Brazil, driven by the exploitation of deepwater fields. Furthermore, the sharp decline in oil consumption during the pandemic allowed for achieving a small exportable surplus.

[1]According to Montamat and Torroba (2021), "The closing of futures positions for May in the United States led oil traders wishing to get rid of their futures positions to pay purchasers to assume the risks associated with transferring and storing physical barrels of oil in already saturated facilities. The facilities in Cushing (a city in the state of Oklahoma), a key U.S. oil storage hub, reached close to peak storage capacity. On April 21, 2020, the WTI (reference price for U.S. crude oil) traded at negative values (-37.6 dollars)".

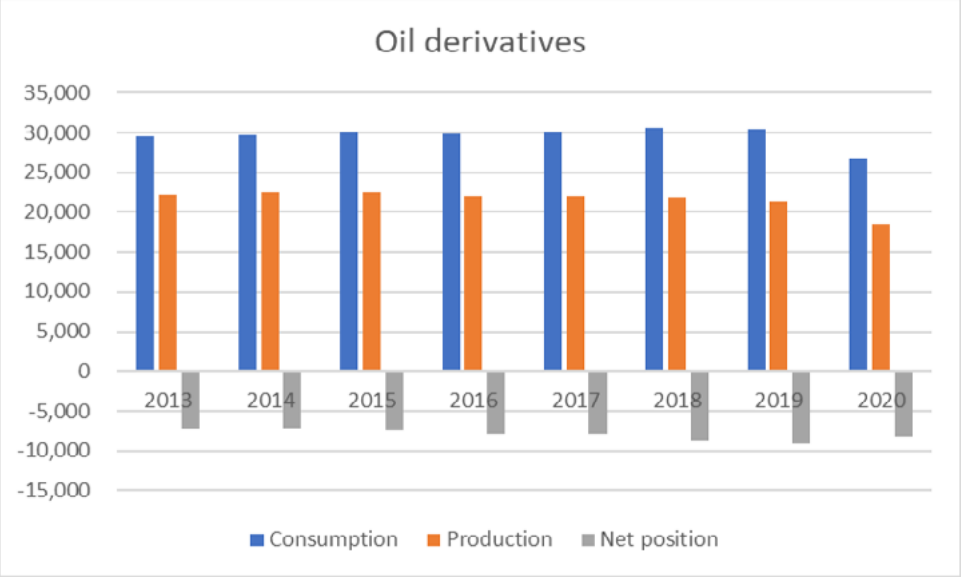
Figure 2: Consumption, production and net balance of oil in the Americas (in thousands of barrels per day)



Source: Prepared by the author based on British Petroleum (2021)

Despite having increased oil production, the American continent has failed to substantially increase its refining capacity. In this regard, although it has reversed its position as a net oil importer, it produces only 70% of total oil derivatives consumed, for which demand has been growing.

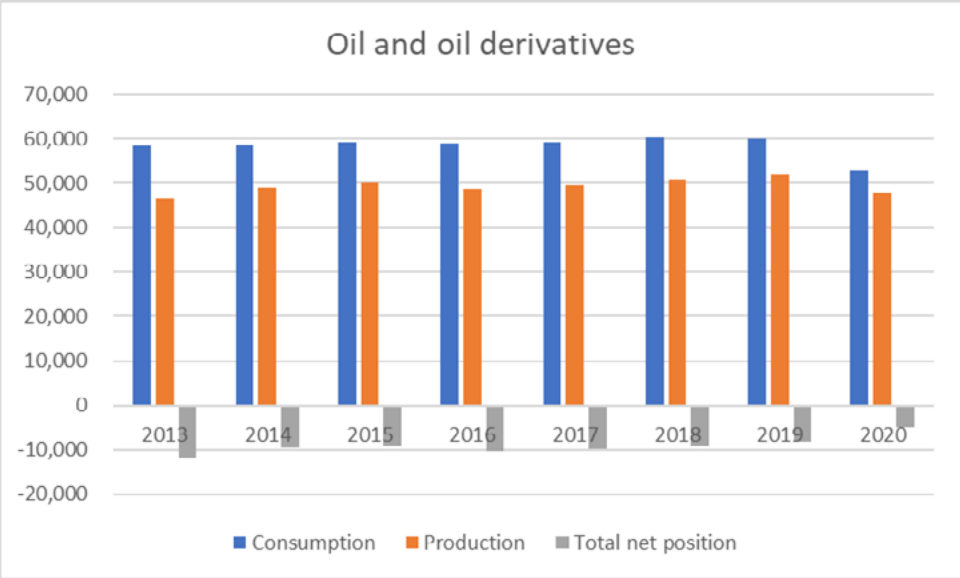
Figure 3: Consumption, production and net balance of oil derivatives in the Americas (in thousands of barrels per day, not including biofuels).



Source: Prepared by the author based on British Petroleum (2021)

Aggregated data for oil and oil derivatives shows that the Americas are sorely in deficit, importing ten million barrels in the years before the pandemic.

Figure 4: Consumption, production and net balance of oil and oil derivatives in the Americas (in thousands of barrels per day, not including biofuels)



Source: Prepared by the author based on British Petroleum (2021)

In view of the foregoing, and given the fact that it imports 13% of the total oil it consumes, the American continent is vulnerable to potential supply crises in the global oil and oil derivatives market.

The contribution of agriculture to energy security

Within this context, the agriculture sector of the Americas, the leading agro-exporting continent, can play a key role in contributing to global food security and even energy security. These two objectives are intertwined, given the fact that diversifying the comprehensive, efficient use of biomass to produce biofuels can increase the efficiency and security of agrifood systems (Trigo et al. 2021).

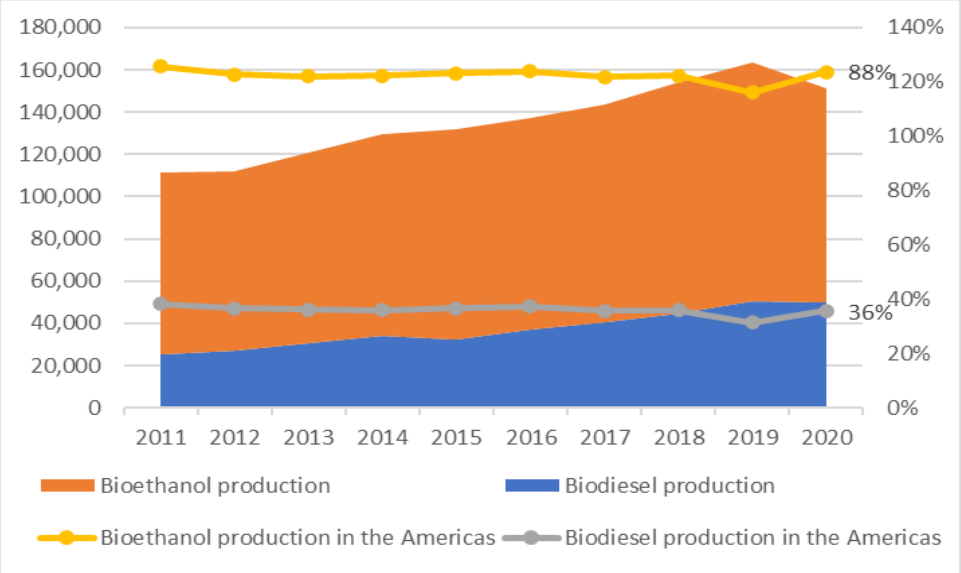
On the other hand, from the point of view of industrial economics, the cracking of biomass yields various by-products. Among these are a series of biomaterials of different added value, such as biofuels, and, in turn, a wide range of products related to animal and human food, as well as other high value-added products linked to the pharmaceutical, alcohol chemical and oleo chemical industries.

Consequently, the efficient, comprehensive cracking of biomass leads to an industry categorized as "multi-product"[2], in which the production of by-products allows for diversifying and complementing biofuel production, which, in turn, facilitates a better distribution of raw material production costs, making the system more efficient and productive (Torroba, 2021a).

In terms of volume, biofuels already contribute more than 150 million cubic meters[3] to the global liquid fuel matrix: 33% in the form of biodiesel and 67% in the form of bioethanol to be blended or to replace gasoline.

The American continent plays an important role in bioethanol production, producing 88% of the total, while its share in biodiesel production is 36%.

Figure 5: Global biodiesel and bioethanol production (in millions of m^3) and participation of the Americas in production



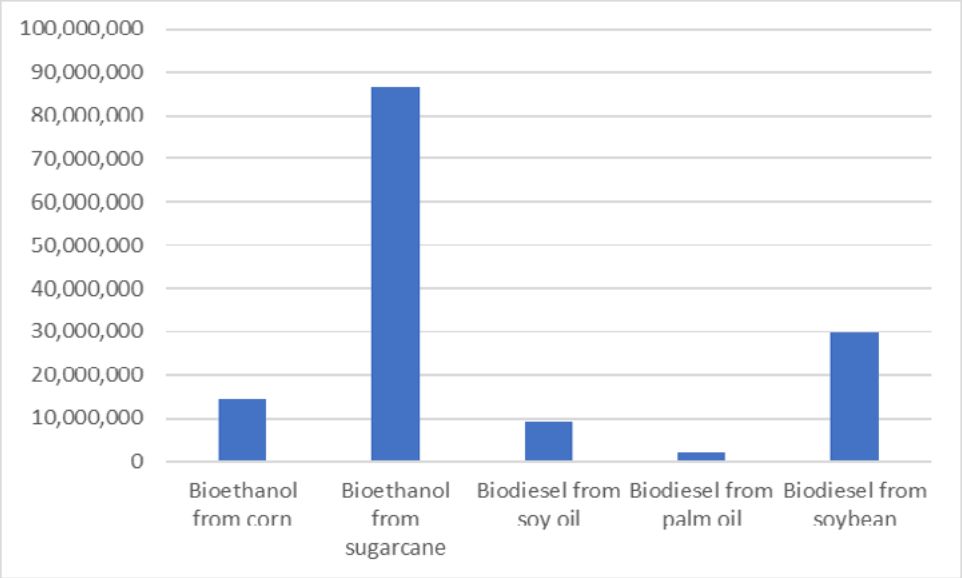
Source: Prepared based on Torroba (2021a).

[2] Baumol, W; Willing, R; Panzar, J. 1988. Contestable markets and the theory of industrial structure. California, United States of America, HBJ.
[3] Equivalent to more than 2.6 million volumetric barrels of biofuels.

The Americas possess a significant exportable surplus of raw materials used to produce bioethanol (corn and sugarcane) and biodiesel (soybean and palm oils and soybeans that can be industrialized[4]).

Considering only its exportable supply, the continent has enough raw materials to double global bioethanol production and increase global biodiesel production by 80%.

Figure 6: Potential to produce biofuel (in m3), based on the exportable surplus of the main raw materials in the Americas



Source: Prepared by the author based on Trademap (2022)

In terms of volume, liquid biofuels currently produced in the Americas could cover 22% of the oil and oil derivatives deficit; the industrialization of the exportable surplus of raw materials could raise this figure to 53%.

The latter figure serves merely to illustrate the continent's potential to expand its production, helping to renew the objective of "energy security"[5].

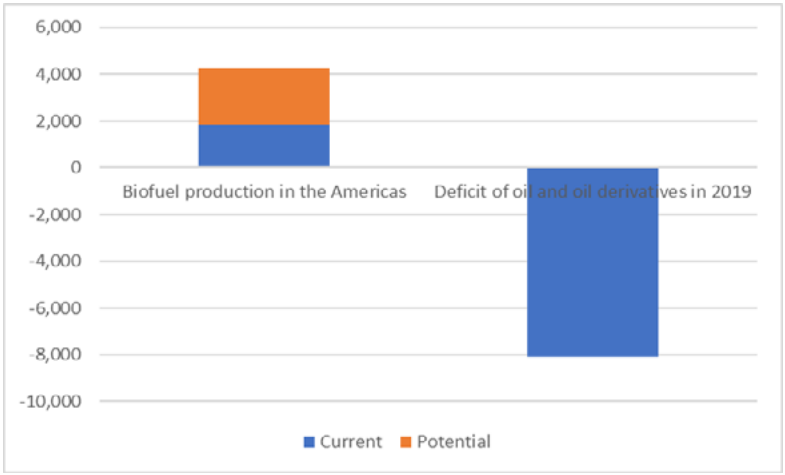
[4]In the case of soybean, it must be industrialized to obtain oil. Soybean oil, in turn, is used to produce biodiesel.

[5]Although most countries promote the use of biofuels for environmental and agricultural development reasons, there are certain cases in which energy security and diversification remain pillars of public policies to promote biofuels. One noteworthy example is the Energy Independence and Security Act enacted by the United States in 2007. One of its fourteen titles is exclusively geared towards providing improved "energy security through increased production of biofuels". This law was preceded by the Energy Security Law of 1980, which also included biofuels, specifically bioethanol, among its key pillars.

Following a sharp increase in international oil prices, Brazil formally implemented the Proálcool program in 1975, including energy security as one of its pillars.

Likewise, the current biofuel policies of Indonesia, Thailand and Malaysia are largely based on matters related to energy security and diversification (Torroba, 2021b).

Figure 7: Current and potential biofuel production and deficit of oil and oil derivatives in the Americas (in millions of barrels per day)



Source: Prepared by the author based on Tradmap (2022), BP (2021) and Torroba (2021a).

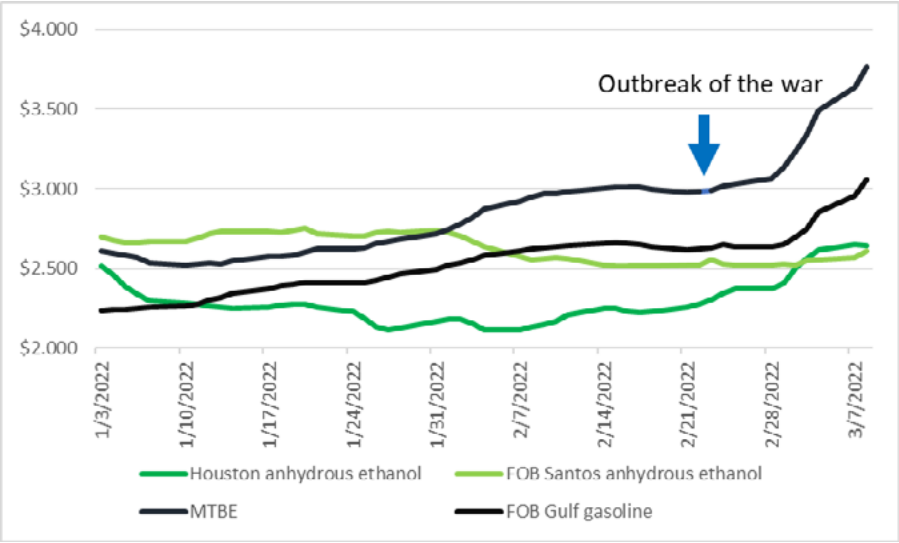
Another aspect worth analyzing is the status of biofuel prices compared to that of the derivatives they replace. High oil prices have translated into higher prices for biodiesel compared to standard diesel, although the difference has narrowed in recent business roundtables.

On the other hand, in the case of bioethanol, whose prices have historically been closer to gasoline prices (cheaper during certain periods and more expensive in others), the situation has become quite favorable in terms of prices.

It is worth noting that bioethanol is used to oxygenate gasoline to replace MTBE (methyl tert-butyl ether); once MTBE has been replaced, it can also be used to replace gasoline.

The current price situation shows bioethanol from corn and sugarcane to be significantly cheaper than MTBE and cheaper than gasoline. Furthermore, as illustrated in the following figure, bioethanol from corn has become more expensive than bioethanol from sugarcane, as a result of the recent increase in corn prices.

Figure 8: Prices of bioethanol, *MTBE* and gasoline, in dollars per gallon



Source: Prepared based on U.S. Grains Council (2022).

A matter worth analyzing is the future evolution of prices for fossil fuels compared to those for biofuels. Prices for crude oil are highly unpredictable; however, various hypotheses were analyzed to try to understand the behavior of oil prices, including those of Pindyck (1999) and Barnett and Vivanco (2003), which point to a "mean reversion" in prices over long periods of time. On the other hand, Cashin *et al* (2000) analyze the persistence of price shocks, while Hamilton (2008) considers a random walk to be plausible, emphasizing that most forecasts are wrong[6].

Despite the high price uncertainty, two key points are worth highlighting:

(i) The biofuels industry has embarked on a path of maturity and competitiveness, considerably improving its production costs over the past decade[7], in addition to increasing the value of its by-products, which has enabled bio-based fuels to become increasingly competitive compared to fossil fuels.

(ii) Environmental commitments favor the sustainable production and consumption of biofuels. This is reflected in the fact that more than 60 countries have mandates in place for the use of biodiesel, bioethanol or both. On the other hand, tax burdens tend to make fossil products more expensive, especially with the increasingly widespread carbon dioxide tax[8]. If fossil fuel and biofuel prices continue to balance out in all other countries in the world, through an increasingly widespread carbon tax and with values set in accordance with experts' recommendations[9], a window of opportunity would open up for biofuels to compete via (final) prices against the fossil fuels they substitute.

Consequently, the new relative prices of oil (although there is no certainty regarding their evolution in the medium and long term) and carbon tax policies, which are becoming increasingly widespread, facilitate the energy transition and favor the development of biofuels even more.

Lastly, although this is not the main topic at hand, the crisis in the natural gas sector could trigger the drafting of policies that foster the use of biogas worldwide. In this regard, global residues originating from forestry, agriculture and organic wastes are estimated to amount to 40 to 170 EJ/year, with a mean estimate of around 100 EJ/year by 2050 (IPCC 2012)[10].

[6]"In terms of statistical regularities, the paper notes that changes in the real price of oil have historically tended to be (1) permanent, (2) difficult to predict, and (3) governed by very different regimes at different points in time", Hamilton (2008, p.1).

[7]Trigo *et al* (2021) note that productivity in the biofuel sector has improved over time, which could have very positive effects on all other food systems processes. In Brazil, the cost of producing sugarcane ethanol declined by 70% between 1975 and 2010. On the other hand, processing costs for corn ethanol in the United States declined by 45% between 1983 and 2010.

[8]According to Bisang and Torroba (2020), "By 2020, there were already 61 carbon pricing initiatives, which covered 22.3% of total global GHG emissions. In turn, 46 national and 32 subnational jurisdictions are covered by this type of initiative".

[9]The Report of the High-Level Commission on Carbon Prices (Word Bank Group, 2017) "concludes that the explicit carbon-price level consistent with achieving the Paris temperature target is at least US$40–80/tCO2 by 2020 and US$50–100/tCO2 by 2030, provided a supportive policy environment is in place".

[10]On March 8, 2022, within the context of the war between Russia and Ukraine, the European Commission presented the "REPowerEU2" plan, geared towards "phasing out our dependence on fossil fuels from Russia". To that end, one of the key pillars of the plan is to increase the volumes of biomethane and renewable hydrogen production and imports, which would contribute to boosting biogas production.

Conclusions

The war between the Russian Federation and Ukraine involves collateral damage, including a negative impact on energy supply and security worldwide.

Within this context, the agriculture sector in the Americas can fulfill a double role: guaranteeing food security, as it has throughout history, as well as strengthening energy security. In this regard, liquid biofuels are particularly relevant, with the Americas accounting for 71% of global production.

It is worth noting that, in terms of volume, liquid biofuels currently produced in the Americas could cover 22% of the oil and oil derivatives deficit; the industrialization of the exportable surplus of raw materials could raise this figure to 53%.

High oil prices, in addition to the tax differential, especially in countries that have a carbon dioxide tax, place biofuels, and bioethanol in particular, in an economically advantageous position that would, in turn, contribute to the transition towards clean energy.

In this regard, opportunities are opening up to expand liquid biofuel production in the hemisphere, which would allow for strengthening energy security. Similarly, the crisis in the natural gas sector could trigger the drafting of policies that foster the use of biogas worldwide.

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