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Corn ethanol in Brazil - yellow alert for sugar?

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Summary

Corn ethanol production has grown rapidly in Brazil. To date, the industry's business model has shown itself to be robust and competitive.

As a result, investment in additional capacity is expected to continue, but the forecast rapid growth has created concerns about a structural oversupply of ethanol in Brazil in the short to medium term.

On the demand side, additional consumption may emerge in several ways: for example, by raising Brazil's mandatory blend of ethanol in gasoline, through a step change in Brazil's ethanol consumption resulting from fuel tax reform, and/or due to rising local and global interest in sustainable fuels for aviation and maritime transport. But much of this is a longer-term (2029-2030) prospect, and with the ramp-up in corn ethanol capacity set to be rapid, it may be hard for demand to grow at the same pace in the short to medium term.

This threat of imbalance in the ethanol market creates a yellow alert for the sugar industry, in Brazil and beyond. An oversupply of ethanol would put ethanol prices under pressure, which could feed through to increased sugar output as Brazil´s mills arbitrage margins on the two products taking sugar and ethanol prices to parity with one another. For 2026, expectations that Brazil´s next (2026/27) cane crop will be large may have already priced in such a scenario.

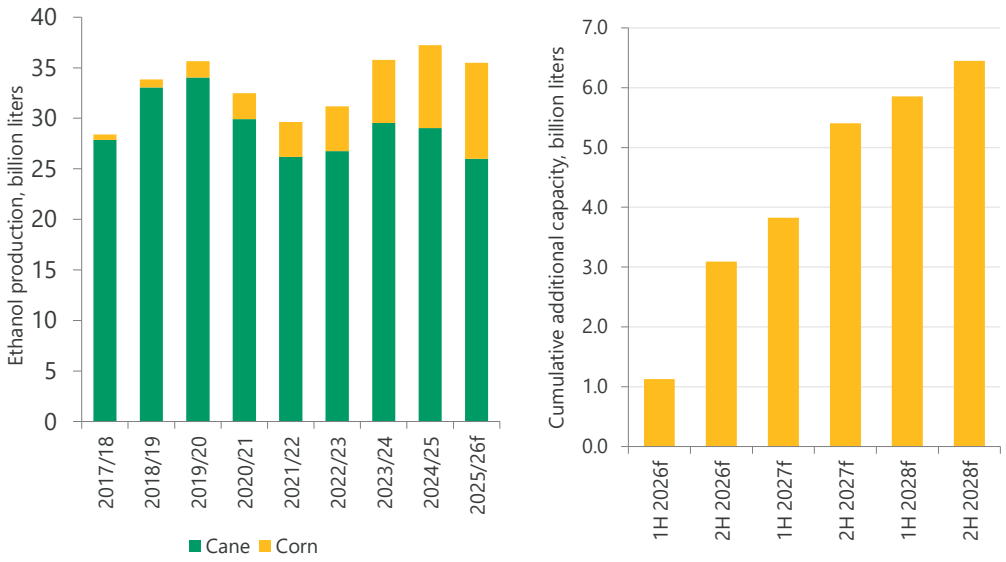
Looking further ahead, there are of course many reasons why it may not be repeated in subsequent years despite the growth in ethanol supply in Brazil – for example, weather events could adversely impact global sugar production, or an upturn in oil and gasoline prices could provide support for ethanol prices. Nevertheless, it merits attention as any major change in Brazil´s ethanol market could have repercussions for sugar players around the world.

Structural change in Brazil's ethanol market

A decade ago, the corn ethanol industry was barely on the radar. Fast-forward to the 2025/26 (April/March) crop year, and following rapid growth, production is expected to be close to 10bn liters via the processing of around 23m metric tons of corn. There are two business models for corn ethanol in Brazil. The first is the "full" plant, the traditional stand-alone industrial facility, and the second is the "flex" plant, a corn ethanol facility annexed to an existing cane mill. The vast majority of capacity that exists or is under construction is of the "full" plant type.

Looking ahead, investment in additional capacity is expected to continue. RaboResearch's analysis of projects authorized by the ANP (*Agencia Nacional de Petróleo e Biocombustíveis*, the government agency that regulates the fuel sector in Brazil), plus projects announced by credible sponsors but as yet not on the ANP's list, suggests that by the end of 2028 there could be as much as 16bn liters of operational capacity to produce ethanol mainly from corn but also from other cereals such as sorghum and wheat.

Figure 1: Corn ethanol in Brazil – share of national production and projected cumulative capacity growth to 2028



Source: UNICA, ANP, RaboResearch 2026

Further ahead, there are numerous forecasts from industry players and consultants suggesting that by the early 2030s, capacity could be over 20bn liters.

The cane sector, which still produces around two-thirds of all ethanol produced in Brazil, cannot help but view the expansion of the corn ethanol sector with concern. In recent years, the cane ethanol sector has been focused on maximizing sugar production from cane, as market prices have been attractive. It has therefore been processing less cane for ethanol, effectively creating space in the market for corn ethanol to grow without precipitating a supply/demand imbalance.

With the cyclical high of sugar prices now firmly in the rearview mirror and corn ethanol capacity relentlessly rising, the short and mid-term outlook points to challenges ahead. For 2026, the cane industry's traditional answer to the low price associated with sugar market in surplus – produce more ethanol and less sugar – could create a glut of ethanol in the domestic market. Poor ethanol price prospects may therefore result in less of a swing away from sugar by Brazilian millers, even with world raw sugar prices struggling to reach USc 15/lb.

Beyond 2026, there could be more of the same ahead, if growing ethanol supply is not matched by rising consumption. The pressure of surplus ethanol in the Brazilian market could push the world's largest exporter of sugar into pressuring global sugar prices via higher output.

A structural change in Brazil's ethanol market represents a yellow alert for sugar. So what should we be watching to better gauge the impact of Brazilian corn ethanol's growth on sugar? In this report we first look at the drivers of the continuing investment in new corn ethanol capacity in Brazil. Then we look at the various possibilities that exist for the creation of additional ethanol demand in the future, potentially reducing the risk of collateral damage to the sugar market.

What's driving investment?

The business model has proven itself to be robust…

For stand-alone ("full") corn ethanol plants, the competitiveness and robustness of the business model to date is based on several key characteristics:

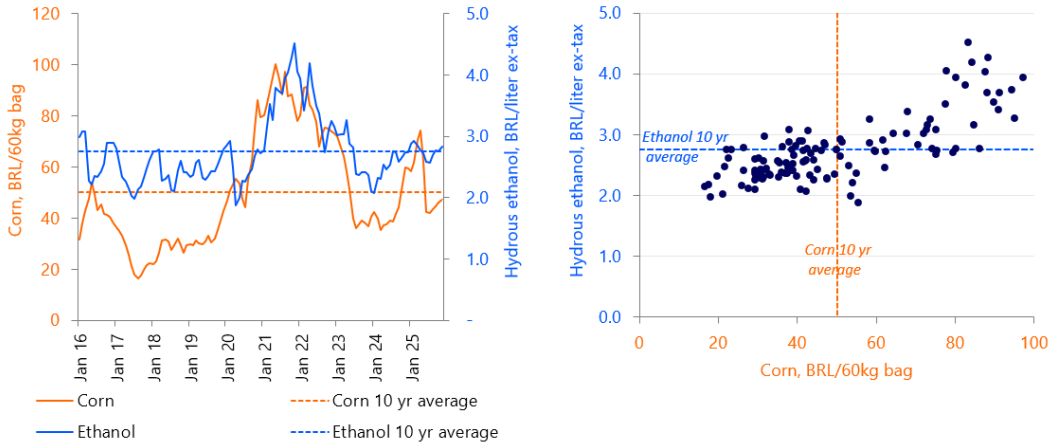
- Most are located in areas where corn is abundant and therefore relatively cheap.
- They tend to be large and have economies of scale in terms of capital cost.
- They generally have substantial warehouse capacity for corn and can acquire and store large quantities of raw material at favorable moments during the price cycle. Plants operate year-round, maximizing fixed asset utilization.
- The coproducts of ethanol production, which are corn oil and distiller's dried grains (DDG) or distiller's dried grains and solubles (DDGS) contribute significantly to revenue.
- There is scope to link DDG/DDGS sales prices to corn prices to create a partial hedge for margins.
- A number of state governments have been willing to provide tax breaks to projects owing to the economic activity and local development generated.

All of these factors contribute to the robustness of the business model. Once up and running, margins have been good in most years and cash generation has been substantial. This, together with the efficiency with which assets are utilized, generates a high return on invested capital (ROIC). As a result, larger and longer-established players in the market have an incentive to keep growing and are able to finance a large share of the cost of new plants or capacity expansion via cash that the existing operation throws off.

Looking back at ten years of price history for corn and ethanol, and adjusting for inflation, the data suggests a reasonable degree of correlation between the two series – at times when corn prices have been higher, ethanol prices have often been higher too (see figure 2). And although it is hard to find any convincing argument for why this relationship should always prevail, it is clear that at least in the past they have been influenced in the same way by the same events. The most obvious example is Russia's invasion of Ukraine in 2022, which had an impact on fuel prices and on grain prices.

The combination of high corn prices and low ethanol prices in 2023/24 meant that it was the toughest year to date for the industry, highlighting the risk of divergent trends in corn and ethanol prices. Mitigating factors often cited are, first, that corn is an annual crop, and high prices in one year should provoke a supply response the following year. Second, DDG/DDGS prices are more correlated with corn prices, providing some cushion against a cost/revenue squeeze. Third, the industry is also looking at complementing corn use with sorghum, which is cheaper and more resilient to dry conditions, so that can affect corn production and prices.

Figure 2: Corn (Mato Grosso) and hydrous ethanol prices (São Paulo), adjusted for inflation*



*Note: All prices expressed in 2025 BRL values.

Source: Bloomberg, CEPEA, Macrobond, RaboResearch 2026

A second risk factor is that stand-alone plants are fueled by wood chips, which enhances the carbon footprint of the ethanol produced but means that large quantities of wood chips (2 cubic meters per cubic meter of ethanol) need to be sourced. RaboResearch calculates that for every million metric tons of corn milling capacity, 10,000 hectares of eucalyptus plantation are required to sustainably supply biomass needs. Currently the cost of acquiring biomass represents around 7% of total cost of goods sold. Nevertheless, there are concerns that, with the continuing expansion of the industry, biomass supply will struggle to match demand, and prices will rise.

It is worth noting that, in the case of "flex" plants, i.e., corn ethanol plants annexed to a sugar mill, there is generally sufficient excess bagasse from the cane operation, such that no fuel needs to be purchased to power corn ethanol production. Flex plants also benefit from reduced capex necessary to construct the annexed corn unit as there is scope to make use of existing equipment in the cane mill's distillery.

… but there are other drivers behind the wave of investment

RaboResearch believes that at least part of the explanation for the proliferation of new corn ethanol projects is the logic of the land grab. Players are moving swiftly to occupy areas that are attractive for a project in terms of raw material prices, or premium ethanol prices, or for other structural or economic reasons. These advantages may not be there for later arrivals, as the first mover's presence may have already influenced local supply/demand and prices.

RaboResearch also believes that a further rationale for constructing new capacity sooner rather than later is that the tax breaks enjoyed by many new products are set to expire in 2032, when a long and gradual process of tax reform is due to be completed. With the clock ticking on tax breaks, there is clearly an incentive to maximize the benefit from these measures.

Too much too soon?

With so much new capacity scheduled to arrive on the market, there is concern that this will usher in a period of excess supply, widening the discount of hydrous ethanol to gasoline at the pump and leading to low ethanol prices. These low ethanol prices would impact revenues for both cane and corn ethanol, but, as highlighted above, the corn ethanol sector believes it has competitive advantages in costs and margins versus traditional cane mills. If so, it may press on with investments regardless of any price pressure that may emerge in the coming years.

On the demand side, the growth of Otto cycle fuel (gasoline plus ethanol) consumption in Brazil is driven by growth in the economy and incomes, together with changes in real fuel prices. RaboResearch's base case for annual Otto fuel consumption growth is 2.0%. With capacity increasing as shown in figure 1, RaboResearch believes that abundant ethanol supplies could push the pump price ratio of hydrous ethanol to gasoline (basis São Paulo) down to levels around 63% (versus an average of around 68% in the last 10 years).

Our model suggests that, unless something else changes, Otto fuel market growth would have to be around 4% per year in the coming four years to maintain a pump price ratio of around 68% for hydrous ethanol relative to gasoline. This seems rather unlikely for now.

One thing that could change is that the cane sector could react to low ethanol prices by diverting ever more cane to sugar production in the coming years – but the market may not necessarily need this extra sugar, and, if it doesn´t, then the world sugar price would likely be arbitraged down to ethanol parity.

So what else is there that could potentially help to offset a sharp rise in supply? Could there be any increase in demand to offset rising supply?

Possible sources of additional ethanol demand

Increased anhydrous ethanol blend in gasoline

Brazil's 2024 "Fuel of the Future" legislative package included an increase in the range of the mandatory blend of anhydrous ethanol in gasoline, raising it to 30%-35%. In August 2025, the mandated blend was raised from the prevailing 27% to 30%. The short-term impact of this was to boost annual anhydrous ethanol demand by 1.0-1.5 bn liters. This meant that more hydrous ethanol was further processed to produce anhydrous ethanol, effectively reducing hydrous ethanol supply and thereby creating support for ethanol prices.

The legislation provides further scope to boost the mandated blend beyond the current 30%, and at fairly short notice, in the event of a structural rise in supply. However, while further raising the mandated blend could contribute to rebalancing the market, it may not be sufficient on its own to fully address the potential increase in supply in the coming years.

Tax reform's potential boost to hydrous ethanol sales

Within Brazil's long-running overhaul and reform of taxation, the structure and level of taxes on gasoline were reformed in 2024, bringing uniformity and a fixed level (in BRL per liter) of tax applied to gasoline at the pump in every state. Hydrous ethanol was not included in that round of reform, and only in 2029 will hydrous ethanol see the beginning of a move to a uniform and fixed tax rate. Moreover, in the "Fuel of the Future" legislation, it is stipulated that the fuel tax system should incorporate a favorable tax differential for biofuels in comparison with their fossil fuel counterparts, although this differential is not defined and therefore will be subject to debate.

This is important because in many of Brazil's states today, hardly a drop of hydrous ethanol is sold, even though the vast majority of cars on the road are flex-fuel vehicles. Part of the issue may be that logistics make competitive pricing of hydrous ethanol difficult in states where there is no production. But relatively high taxes on hydrous ethanol are also a factor.

Tax reform from 2029 therefore has the potential to open up a significant part of domestic Otto fuel market to hydrous ethanol, assuming that the tax differential applied to hydrous ethanol is meaningful. Moreover, the establishment of corn ethanol facilities (and wheat-based ethanol in the south) in regions where ethanol consumption has traditionally been limited to the mandatory blend of anhydrous ethanol in gasoline should also help to open up the market.

However, it is worth noting that there are other challenges that may need to be addressed. In some of the states where little or no hydrous ethanol is sold, there are no hydrous ethanol pumps at gas stations – precisely because to date it has been uncompetitive. So investment in infrastructure will also be required in order to make hydrous ethanol sales viable in these regions.

SAF, maritime fuel

The carbon footprint of Brazilian ethanol, whether it is made from cane or corn, makes it an interesting feedstock for advanced sustainable fuels that could be used either in aviation or maritime transport.

RaboResearch has already produced several reports on the outlook for sustainable aviation fuel (SAF) in Brazil (*Brazil's ethanol sector and sustainable aviation fuel: preparing for take-off*) and beyond. At a global level, the latest analysis from the International Air Transport Association (IATA) points out that most of the current SAF production capacity, and the capacity scheduled to come on line in the next few years, is based on the hydroprocessed esters and fatty acids (HEFA)

technological pathway, using oils and fats as raw material. The alcohol-to-jet (AtJ) pathway, for which ethanol is a raw material, has yet to be implemented on a large scale across a number of commercial projects. IATA sees AtJ technology as ramping up globally around 2030, when the technology at commercial scale should be more mature and when supply constraints in the face of rising demand may affect the prices of fats, oils, and HEFA-based SAF.

The case for ethanol as a sustainable maritime fuel is gaining ground as large fleet operators (for example, Denmark's Maersk) test its use in dual-fuel vessels. The extent to which this creates new offtake opportunities for ethanol depends on the rate of entry of dual-fuel vessels into the global fleet (alternative fuel vessels represented around 2% of the global maritime transport fleet in 2025) and on ethanol's emissions reductions, cost, and ease of use in comparison with other alternatives.

In both the cases of SAF and maritime fuels, it is essential that the ethanol sector work with technology providers and potential offtakers to establish the mutual understanding and trust that will be essential in creating robust supply chains and partnerships for sustainable fuels.

Exports

If domestic demand doesn't grow in line with ethanol supply in the coming years, what about boosting exports as a way of clearing the market? Brazil's ethanol exports have flatlined over the last decade, in a range of 1.4bn-2.4bn liters per year, and the US is the currently the world's leading exporter of ethanol. If the EU-Mercosur trade agreement is implemented, there is scope for Brazil´s ethanol exports to the EU to grow gradually over the six year implementation period, but the additional volume (0.3bn-0.4bn liters compared to flows in recent years) is modest. While it is possible that rising demand for sustainable fuels, or for sustainable feedstocks for advanced fuels such as SAF, could translate into higher ethanol exports for Brazil in the future, at present there is little sign that this could happen in the next year or two.

Others

Among other possible new sources of ethanol demand is the use of ethanol as a fuel for agricultural machinery such as tractors and harvesters – news has emerged of breakthroughs in technology achieved by manufacturers, but ethanol-powered models have yet to be made commercially available. Meanwhile, in 2025, an ethanol-powered electricity generation project was scheduled to enter an auction to supply reserve generation capacity for use at times of peak demand in northeast Brazil. Although the auction was cancelled, the project highlights that developments in engine technology may make the use of ethanol rather than fossil fuels like diesel a viable option for reserve energy generation.

Conclusion

It is not certain that the current wave of investments in corn ethanol capacity will create a structural oversupply of ethanol in Brazil in the short to medium term, but it is possible.

There are many reasons why it may not happen: unfavorable weather in Brazil or in any other major player in the sugar market could precipitate an upswing in the global sugar price cycle, or a run-up in international gasoline and energy prices could keep ethanol prices attractive even if their discount to gasoline prices at the pump were to increase. But these are not really candidates for a "base case" scenario.

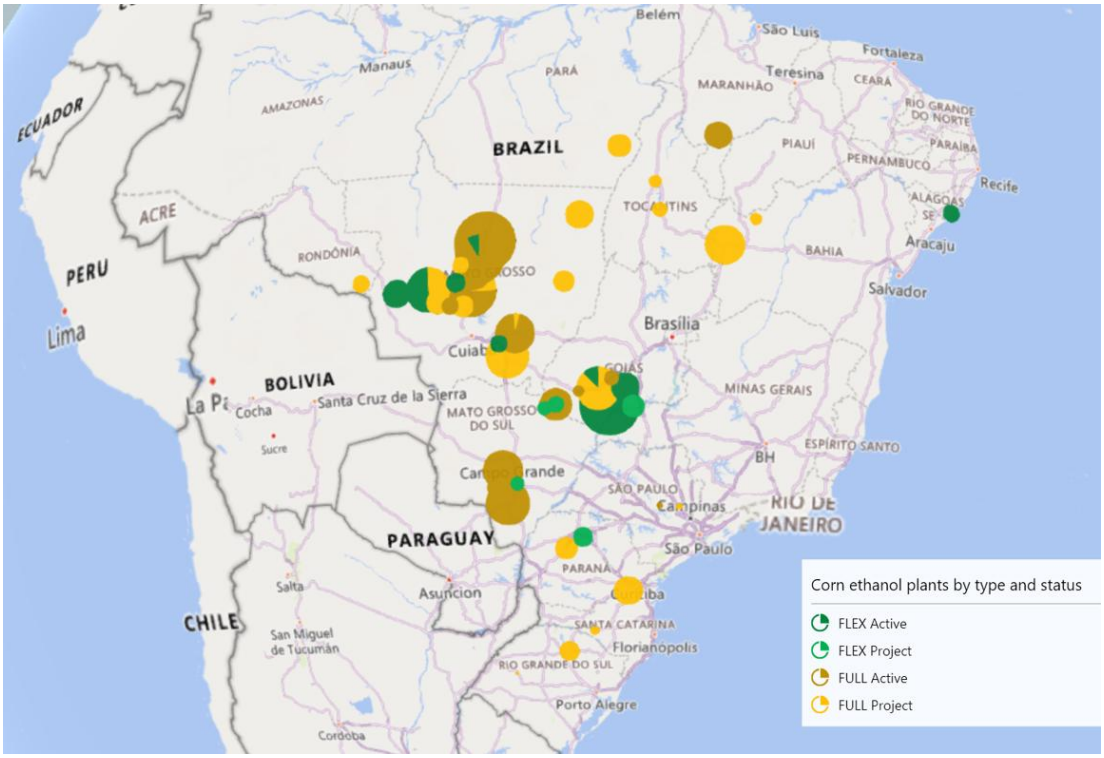
To date, little has deterred the pace of investment in new corn ethanol projects, especially by established players, who benefit from the strong cash generation of projects already up and

running. It is true that some projects from newcomers to the sector appear to have fallen by the wayside – possibly derailed either by Brazil's high interest rates or via a preemptive move by an established player into nearby territory.

There are various possible sources of new ethanol demand that may emerge, and in the long term RaboResearch believes that, as a group, they could lead to a substantial increase in offtake for Brazilian ethanol at home and abroad. In particular, the expansion of the domestic motor fuel market via tax reform and global interest in sustainable fuels from the aviation and maritime sectors have potential to really move the needle. But these are longer-term prospects, while the ramp-up in capacity is set to be rapid. In the short to medium term it will be a real challenge for demand to grow at a pace that matches the expected rise in supply.

This threat of imbalance in the ethanol market creates a yellow alert for the sugar industry, in Brazil and beyond. An oversupply of ethanol would put ethanol prices under pressure, which could feed through to increased sugar output as Brazil´s mills arbitrage margins on the two products, taking sugar and ethanol prices to parity with one another. It may not happen, but it merits attention – any major change in Brazil´s ethanol market could have repercussions for sugar players around the world.

Appendix: map of existing and planned plants



Locations are approximate; bubble sizes represent daily ethanol production capacity as reported by the ANP.

Imprint

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