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Sustainability

Biofuels: Turning food into fuel

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Key takeaways

- Biofuels have grown at a much faster pace than fossil fuels, tripling in size in the past 15 years. Green molecules today make up 3% of global total petroleum supply, and are a growing global trend, per BofA Global Research.
- An important driver behind the supply growth in the US is the skewed subsidies that support distillates based off renewable feedstock over other kinds of biofuel products, setting up incentives to grow some green molecules over others. As a result, most of the growth in US supply has come from renewable diesel rather than biodiesel or ethanol.
- Meanwhile, biogasoline and ethanol demand growth has slowed on less ambitious blending mandates, rising electric vehicle sales, and more conventional gasoline availability. But sustainable aviation fuel (SAF) credits from government programs like the Inflation Reduction Act aid growing decarbonization efforts.

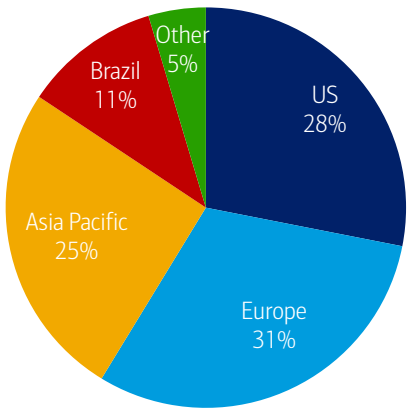
The global capacity for biodiesel and ethanol keeps expanding

According to the Department of Energy (DOE), biofuels are liquid fuels produced from renewable biological sources, including plants and algae. Biofuels offer a solution to one of the challenges of solar, wind, and other alternative energy sources, and these energy sources have potential to reduce dependence on fossil fuels and yield environmental and economic benefits per the DOE.

While prices and margins have faltered, biofuels have grown at a much faster pace than fossil fuels over time, tripling in size in the past 15 years. Today, green molecules make up a little over three million (mn) b/d (barrels per day) or 3% of global total (petroleum) liquids supply.

Plus, biofuels are a global trend, with both emerging markets and OECD (Organisation for Economic Co-operation and Development) economies alike as well as biodistillates, green liquids produced by condensation, and biogasolines experiencing fast consumption growth (Exhibit 1).

Exhibit 1: The US, Europe and Asia are the largest markets in the world for this product
World biomass diesel consumption in 2023



Source: Energy Institute

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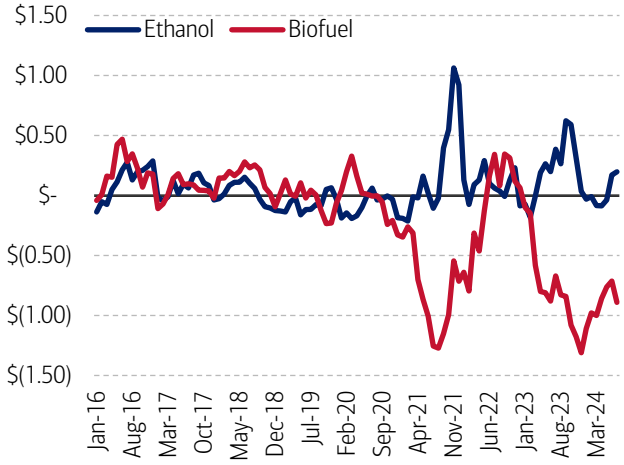
Exhibit 2: Net returns for biodiesel has remained below ethanol for more than a year
US biofuel and ethanol net returns



Source: Iowa State University

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Currently, corn, sugar, and soy oil remain the bulk of the feedstock, or raw materials, used by biofuel producers today, and established subsidy and/or tax programs encourage their use. But financials are an issue for the biofuels industry, as net returns for biodiesel largely have remained below that of ethanol for almost four years (Exhibit 2).

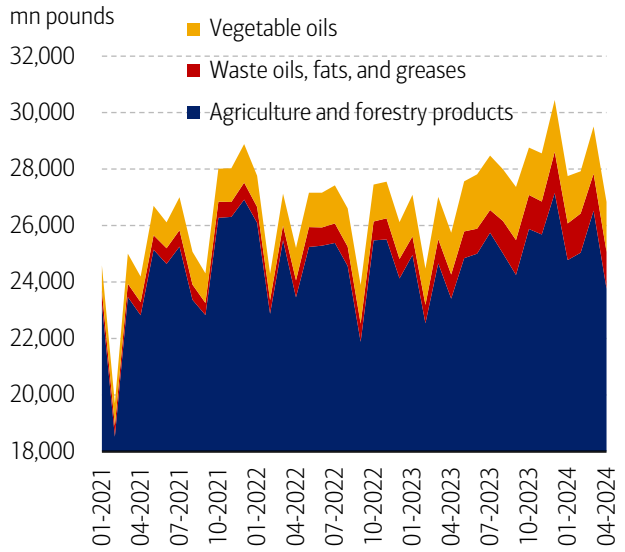
What's in biofuels?

While all gasoline and diesel are made with crude oil, a peculiar aspect of biofuels is that the input used in their production varies significantly. The initial wave 20 years ago pushed to convert traditional crops like corn, sugar, and soy into first generation biofuels, but now the focus has shifted to alternative non-food feedstocks such as crop residues, wood residues and dedicated energy crops.

Exhibit 3 shows that feedstock consumed for biofuel production in the US has shifted away from corn and soy. Notably, US gasoline and ethanol demand has been stagnant, while biodiesel consumption has surged in recent years.

An important driver behind the supply growth in the US is the skewed subsidies that support distillates based off renewable feedstock over other kinds of biofuels products, setting up incentives to grow some green molecules over others. As a result, most of the growth in supply in the United States has come from renewable diesel, rather than ethanol, or biodiesel (Exhibit 4).

Exhibit 3: Feedstock consumed for biofuel production in the US shows a shift away from corn and soy
US feedstock consumed for biofuel production



Source: EIA

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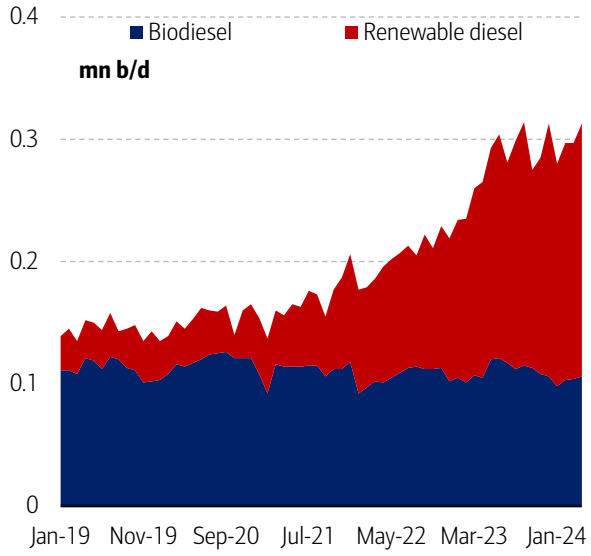
Exhibit 4: Most of the growth in US supply has come from renewable diesel, not biodiesel, sine 2021
US biomass-based diesel production



Source: EIA

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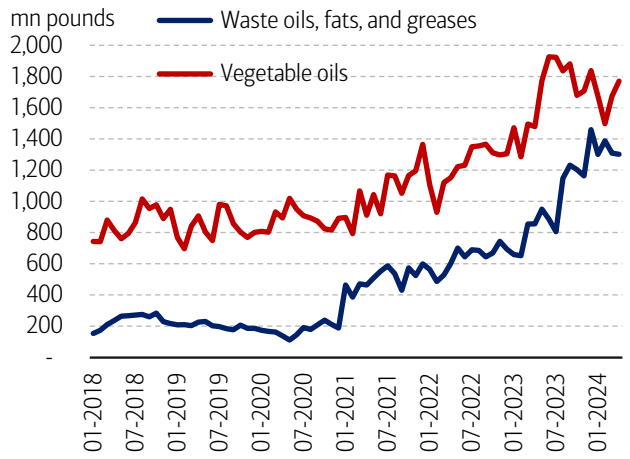
In terms of inputs, the first generation of biofuels based on corn and soy are giving way to a new set of fuels that are produced from a broad range of inputs. When it comes to the distillates sector, the US is currently leading the world expansion in terms of biomass-based diesel production with the amount of waste oils, fats and greases rapidly catching up to the use of vegetable oils (Exhibit 5).

Ultimately, sourcing increasing volumes of feedstock will likely be the main challenge that many producers will face. Thus, new inputs such as agricultural residue, municipal solid waste or forestry waste could lead the way in the future.

While the growth in vegetable and waste oil has been strong on the back of an appropriate set of incentives, agriculture inputs into biofuels production have remained stable as governments have tried to avoid a food vs. fuel competition.

Here, it is worth noting that canola oil has quickly displaced other inputs in the production process of biodiesel in America, a trend BofA Global Research expects to continue going forward until more waste products and better technologies to process them become commercially available in the coming years (Exhibit 6).

Exhibit 5: Waste oils, fats and greases are rapidly catching up to the use of vegetable oils
Waste oils, fats and greases vs vegetable oils used for US biofuel production



Source: EIA

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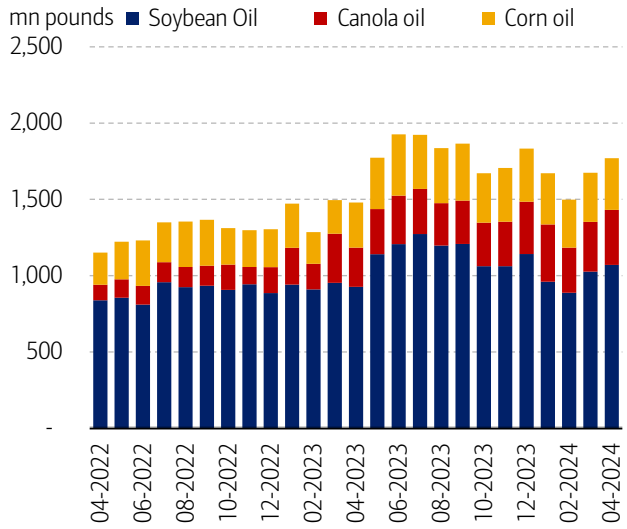
Exhibit 6: Canola oil has quickly displaced other inputs in the production process of biodiesel in America
Different types of vegetable oils used for biofuel production in the US



Source: EIA

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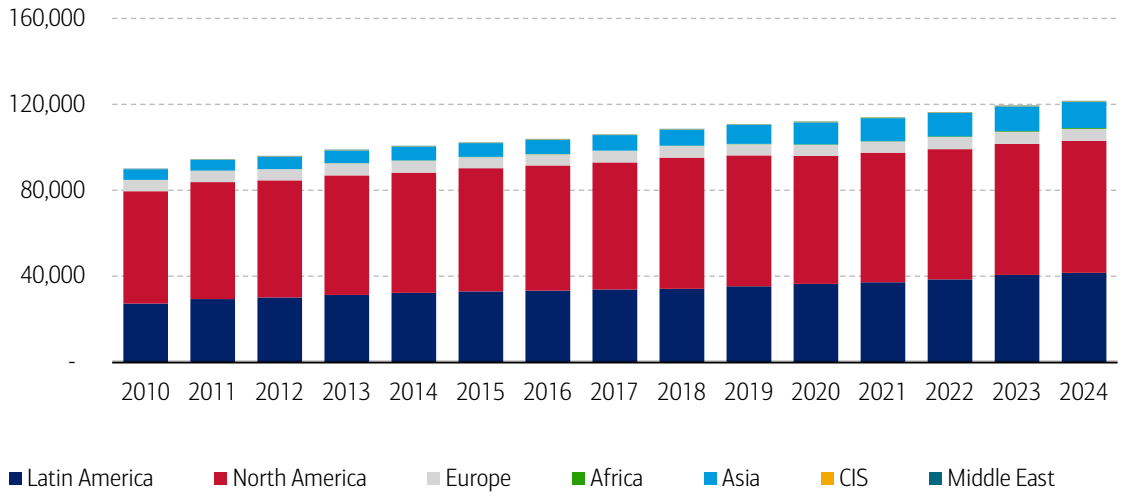
Biofuels growth in the US is a renewable diesel story

Despite financial issues, growth potential exists for biofuels, primarily in the renewable diesel sector, per BofA Global Research. Already, global fatty acid methyl ester (FAME) biodiesel capacity, which is used to extend or replace mineral diesel and gas oil, has expanded from 53 million (mn) tons (t), or 2 billion pounds, in 2010 to 72mn t in 2024, or about 2.3% annually.

Meanwhile, growth in ethanol production capacity around the planet grew from 90mn t in 2010 to 122mn t in 2024, or about 2.2% annually (Exhibit 7). In both cases, annual supply growth for both fuels has exceeded the average global gasoline and diesel demand growth in the past few years.

Exhibit 7: Growth in ethanol production capacity around the planet grew from 90mn t in 2010 to 122mn t in 2024, or about 2.2% annually
Global ethanol production capacity (mn t)



Source: Energy Institute

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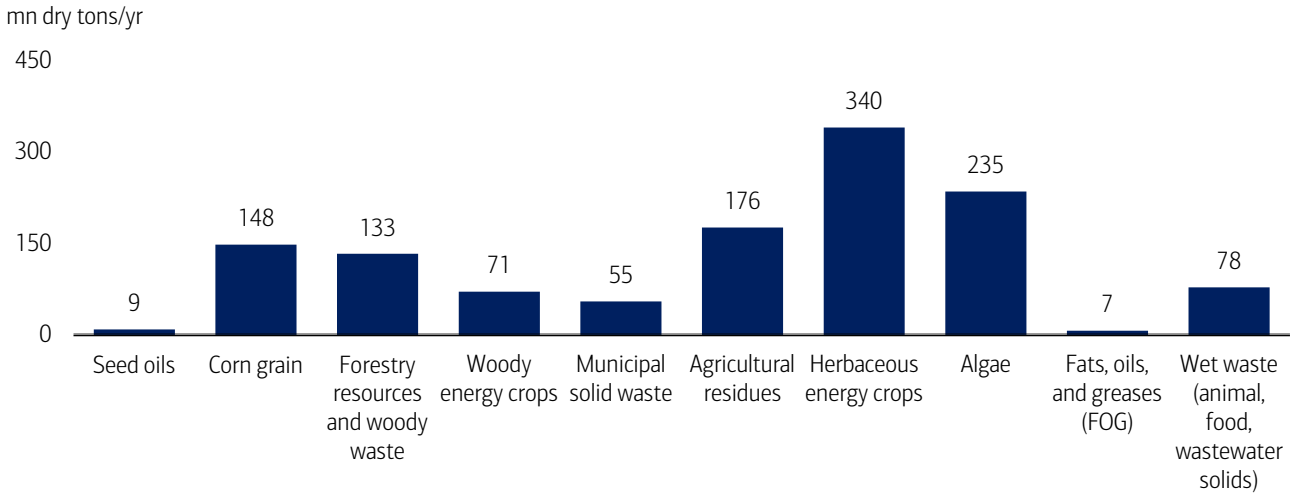
While biodiesel burn has surged on the back of its growing use in trucks and planes, growth trends have eased materially for biogasoline. Why? For one, there is OECD demand for conventional gasoline, and for two, blended mandates have yet to expand in many markets per BofA Global Research. As such, Brazil and the US remain the world's biggest consumers of biogasoline with Asia and Europe lagging.

Importantly, there is a growing divergence between biogasoline and biodiesel demand trends as decarbonization efforts intensify. Decarbonization requirements can be fulfilled from a variety of feedstock pools, but they vary in potential (Exhibit 8). It is another issue that governments have encountered when trying to square the biofuels circle as conventional fuel demand trends are changing rapidly due to electric vehicle adoption (see: Auto affordability and Is the EV transition running out of charge?).

Exhibit 8: Herbaceous energy crops and algae have the highest feedstock pool potential to contribute to decarbonization requirements
US feedstock pool potential



Source: Energy Information Administration (EIA)

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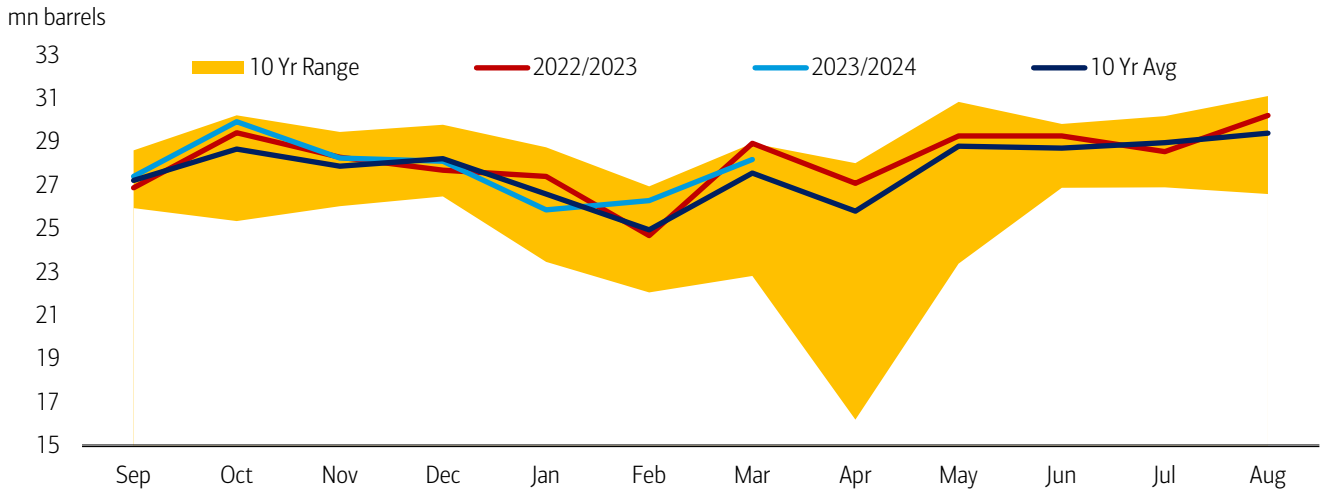
Interestingly, ethanol production in the US has continued to grow in recent years and sits above the 10-year average with total output now exceeding 1mn b/d, according to BofA Global Research. Why is this?

One factor comes from a mandate requiring ethanol in the US to be blended in gasoline. A typical E10 gallon contains 90% conventional gasoline and 10% ethanol. Therefore, the US market can only absorb so much biogasoline at once. This has ultimately contributed to push ethanol inventories in America to the top end of the historical 10-year range as production expanded, according to BofA Global Research.

Yet, US gasoline demand growth is slowing down, which in turn is hitting ethanol demand as monthly average gasoline demand in the US has shifted from 9.31mn b/d in 2019 to 8.94mn b/d on average in 2023 (Exhibit 9).

Exhibit 9: Part of the challenge for biofuels is that US gasoline demand growth is slowing down, and in turn, hitting ethanol demand
US ethanol consumption through March (monthly)



Source: EIA

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Sustainable aviation fuel policy mandates aid demand

Both biofuel and biofuel credit prices lagged in the past year for a range of reasons. Yet, a factor supporting all biofuel producers going forward is a renewed focus on blending mandates for biodistillates.

In the US, the Inflation Reduction Act provides some significant credits for sustainable aviation fuel (SAF) blending into jet fuel as rising costs of airline emissions help push the industry toward low carbon alternatives. Granted, SAF remains expensive and costs a multiple of conventional jet fuel to produce. However, there are a number of waste-to-biofuel conversion technologies, including gasification-based conversion, pyrolysis, and cellulosic biofuel technology (enzymatic hydrolysis) that could eventually compete to bring down costs.

For now, according to BofA Global Research, blending mandates means that SAF production capacity (mostly hydroprocessing) is quickly expanding to meet the steep decarbonization commitments by corporates and countries set out over the course of the next 25 years.

Contributors

Taylor Bowley

Economist, Bank of America Institute

Sources

Francisco Blanch

Commodity & Derivative Strategist, BofA Global Research

Michael Widner

Commodity Strategist, BofA Global Research

Warren Russell, CFA

Commodity Strategist, BofA Global Research

Daryna Kovalska

Commodity Strategist, BofA Global Research

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