

Agri

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UCO Supply Outlook

Global Supply and Trade of Used Cooking Oil

Rationale for the study

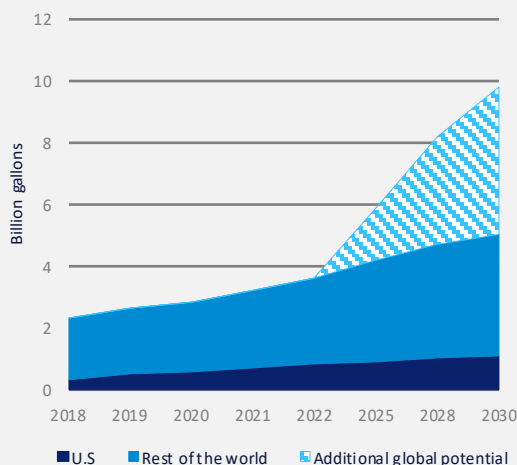
As a low CI feedstock, Used Cooking Oil (UCO) has become a key feedstock for biomass-based diesel with many policies incentivizing the use of low carbon fuels. However, as a waste product its supply is intrinsically limited which has led to questions around how much additional UCO will be available globally to meet the growing demand.

In assessing the future for the U.S. biodiesel sector, Clean Fuels Alliance America has commissioned LMC/GlobalData¹ to forecast the supply of UCO to assess if there is sufficient supply to meet growing demand from the biomass-based diesel sector.

Key Conclusions

- Global available supplies of UCO are estimated at 3.7 billion gallonsⁱⁱ in 2022.
- The U.S. has seen increased collection rates and has one of the most developed collection networks in the world. In 2022 UCO collection (including yellow grease (YG)ⁱⁱⁱ) reached 0.85 billion gallons.
- Asia is the largest supplier of UCO to the world market, led by China which has been the largest exporter since 2017.
- Historically, UCO collection was driven by regulations covering waste oil disposal. Over the last decade, the key driver of demand has been biofuels policy, led by the EU and California where waste/low carbon feedstocks are more highly sought after than crop equivalents.
- Trade is a key part of the UCO market. Global UCO exports in 2022 reached 1.3 billion gallons with two thirds of that total coming from Asia.
- The U.S. has seen rising demand domestically for UCO, particularly as renewable diesel processing capacity has increased.
- The value of UCO as a feedstock in biomass-based diesel has seen UCO prices rise, incentivizing increased collection.
- Globally, biofuels policies have seen a rising proportion of UCO supply used in the production of biofuels. Use of UCO in low value end uses has decreased, these now make up only 20% of consumption.

Diagram 1: Global outlook for available UCO supplies



- **We forecast that global UCO supplies will rise from 3.7 billion gallons in 2022 to between 5 and 10 billion gallons in 2030.** There is further potential to increase supply in the long term. However, logistical barriers to setting up widespread collection networks in some countries will require additional support to the high prices which have seen collection increases so far.
- **This will add 1.4 - 6.1 billion gallons of UCO to world supply, equivalent to 1.3 – 5.8 billion gallons of renewable diesel.**
- **U.S. supply is forecast to rise to around 1.1 billion gallons in 2030.**

UCO supply & consumption

UCO is one of the most readily available waste greases globally. Predominantly collected from restaurants and food preparation factories, historical supplies were limited to those countries with incentives to collect and use waste greases. More recently, the number of countries collecting significant volumes has increased rapidly as demand for imports has expanded, supported by rising incentives.

As a waste product, the supply of UCO is linked directly to demand for cooking oil driven by consumption of fried foods, which is strongly linked to GDP and disposable income. The volume that is collected and available for use is then driven by incentives and regulations. Due to the nature of the product, the UCO market is opaque. We estimate available supplies to show volumes that are collected and available to the market. For our forecasts we also consider the maximum potential volume that could be collected.^{iv}

Diagram 2: Global available supply of UCO

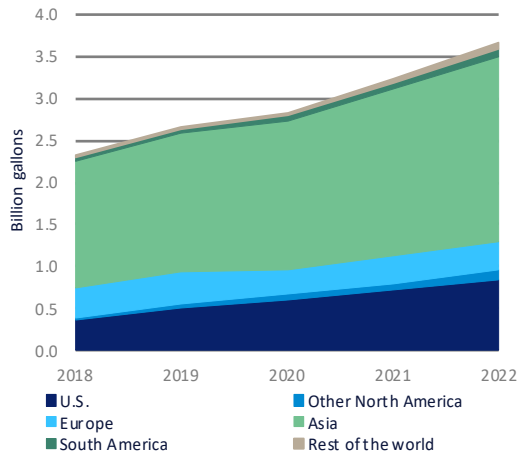
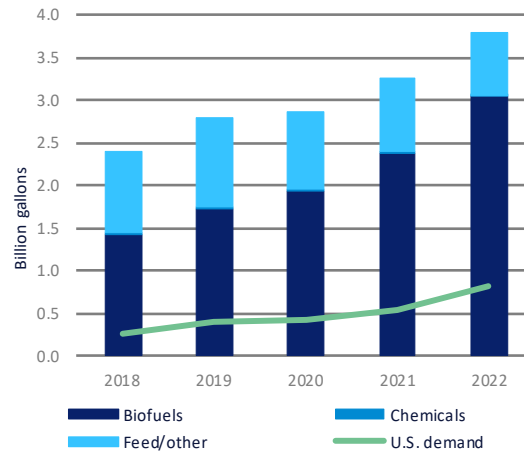


Diagram 3: Global consumption of UCO

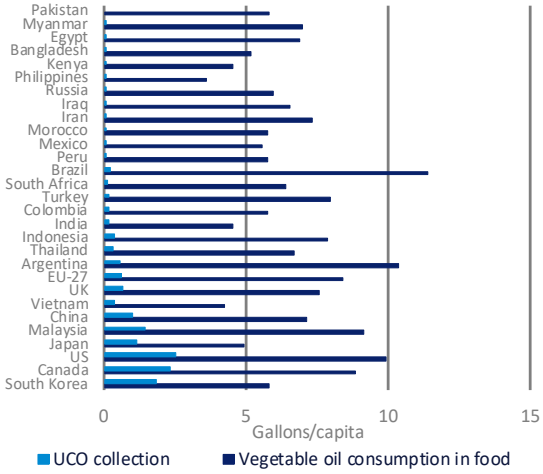


- 2022 available supplies of UCO globally are estimated at 3.7 billion gallons.
- The U.S. has seen strong growth in collection thanks to incentives for the use of UCO in renewable fuels production, with domestic supply reaching 0.85 billion gallons in 2022.
- Asia is by far the largest supplier of UCO, the majority of this volume is exported to other markets (either as UCO or converted into biomass-based diesel domestically and then exported).
- Consumption globally has been driven by increasing demand from the biofuels sector for low carbon feedstocks. In 2022 we estimate that 80% of the total market was used in the production of biofuels.
- Some volumes of UCO are used in lower value end uses such as animal feed. The consumption in these end uses is shrinking. This is due, in part, to stricter regulations over the use of waste oils in animal feed. This has aided the switch from feed to fuels. In the U.S., UCO consumption in non-biofuels end uses had fallen to negligible levels by 2016, prior to the major increase in UCO use in biodiesel.

Collection rates

The volume of UCO collected on a per capita basis varies widely from country to country. This is driven primarily by the collection networks that are in place. Another limiting factor is the per capita consumption of vegetable oil in food.

Diagram 4: Per capita vegetable oil consumption and UCO collection rates, 2022

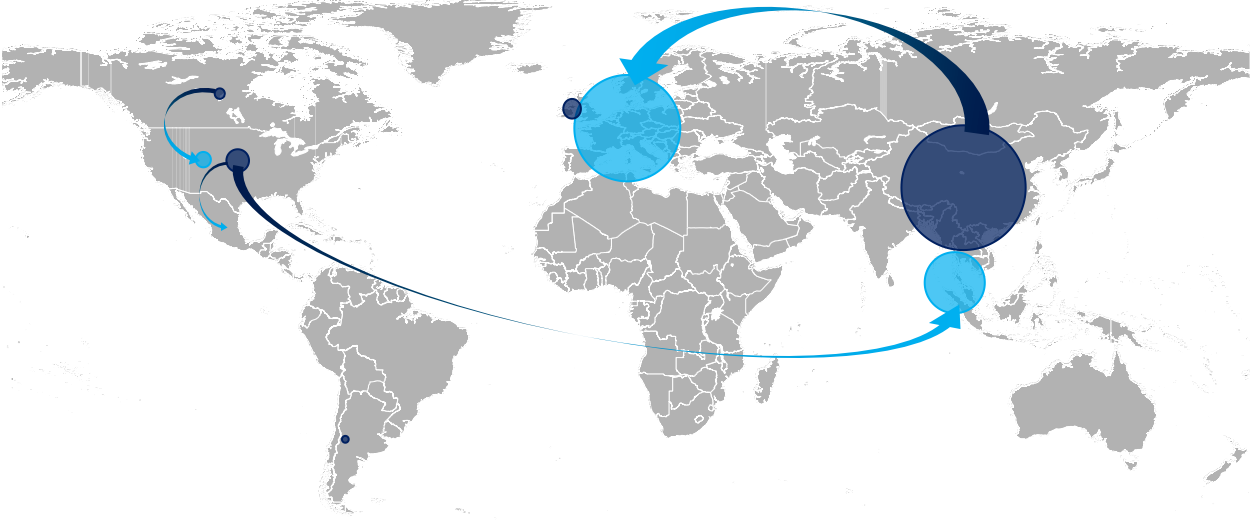


- The U.S. has high oil consumption and developed UCO collection. This implies that a quarter of oil used in food is recovered as UCO. There is some room for growth in these collection rates.
- China has some room to increase their collection rates with around 15% of oil recovered.
- Countries with lower per capita oil consumption find collection more difficult. However, if infrastructure issues can be overcome there is potential to increase supplies.
- Countries with high levels of oil consumption per capita and low UCO collection, could offer significant potential for new supplies.

UCO trade

Trade is a key part of the UCO market. Trade of UCO has increased rapidly over recent years from around 300 million gallons per year a decade ago to 1.3 billion gallons in 2022.

Map 1: Key UCO trade flows (2022, total exports = 1.3 billion gallons)



* Dark blue denotes exports, light blue are imports. Circle size reflects the volume of UCO exported/imported.

- Asia is by far the largest source of UCO exports, led by China, exporting two thirds of total exports in 2022.
- Asia also sees a significant volume of imports. Some of this is imports for re-export with smaller shipments from the region brought together to export in larger volumes, Malaysia is a particular hub for this consolidation.
- Europe is the largest importer of UCO thanks to strong incentives to use waste-based biofuels.

- The U.S. has been a significant exporter of UCO in the past but as domestic demand has ramped up, we have seen exports falling and imports increasing. Some of the downturn in exports has been driven by regulations on the use of UCO in feed, restricting demand. Based on trade in the first quarter of 2023, the U.S. is set to become a net importer of UCO.
- Trade in UCO has had no impact on trade of vegetable oils as UCO demand is typically additional to vegetable oil demand.

Diagram 5: U.S. UCO exports (2015-23)

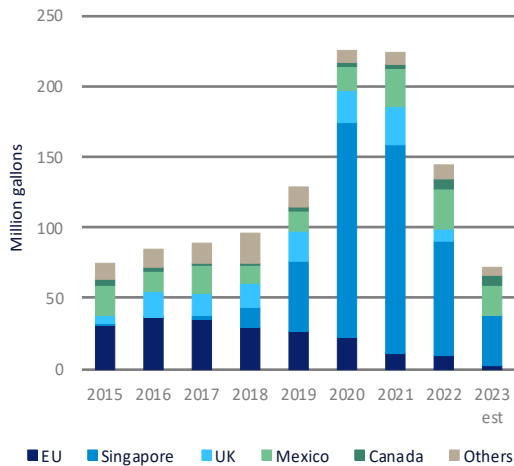
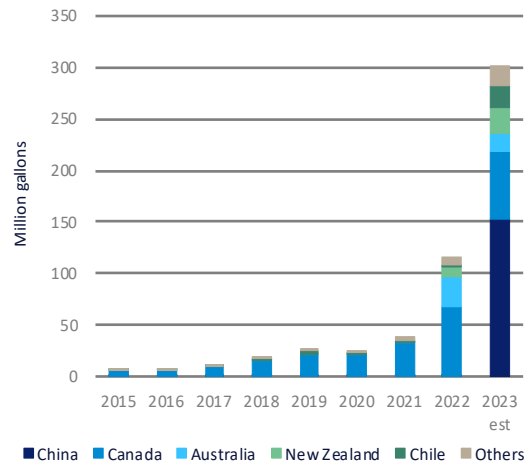


Diagram 6: U.S. UCO imports (2015-23)



*2023 estimate is pro-rata based on Jan-Mar data.

UCO outlook

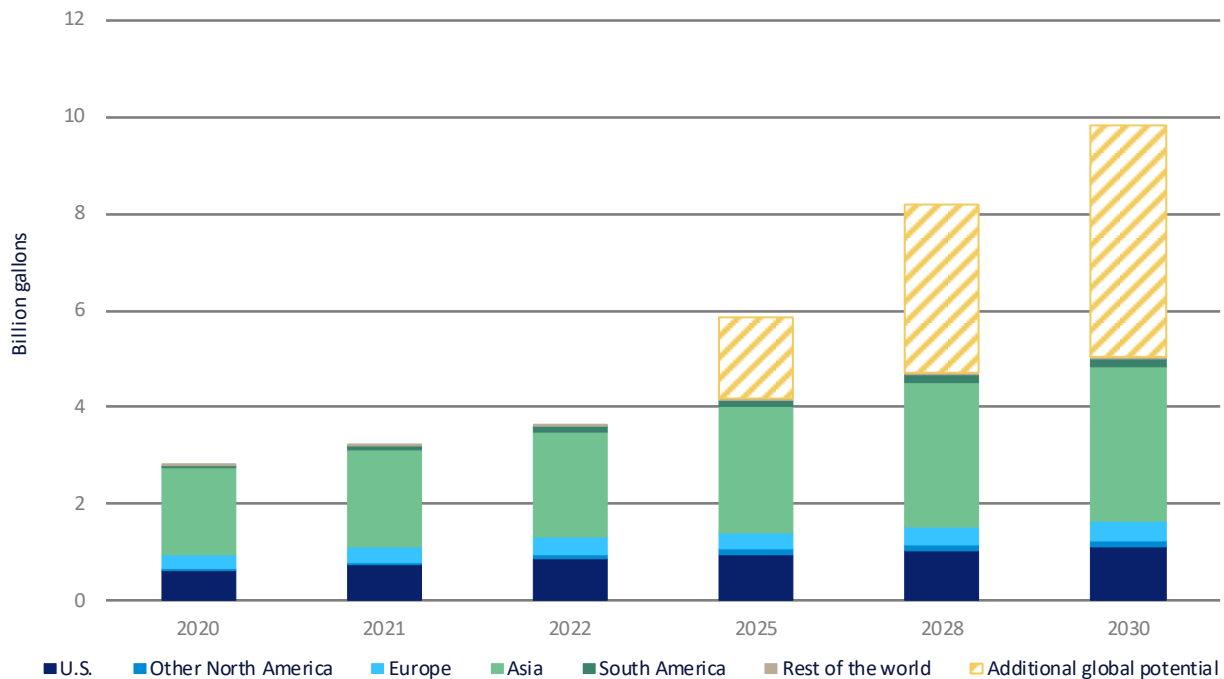
Biofuel policies around the world have driven demand for UCO as a low carbon, waste feedstock. The EU and California have led this movement, but an increasing number of states and countries are planning to adopt low carbon transport policies which will give higher value to UCO-based fuels compared to crop-based fuels. At a federal level, the U.S. SAF tax credit and renewable fuel Production Credit are both linked to the CI value of the renewable fuel. Additionally, plans for sustainable aviation fuel policies are also expected to focus on GHG savings, with the EU expected to ban or limit the use of crop-based fuels (negotiations over the policy are ongoing).

- These policies have driven and will continue to drive demand for waste oils and fats as feedstocks for biofuels.

These policies do not specifically incentivize the use of UCO but a range of low carbon feedstocks. UCO has seen the strongest growth in supply in response to rising demand as the potential volumes are large and the barriers to collection relatively low, particularly in countries where regulations over disposal of waste oils are enforced. Other low CI oils and fats with significant available volumes include animal fats (supplies are determined by meat consumption and rendering practices) and distillers' corn oil (supplies linked to corn ethanol production). The market for UCO is much more opaque than these alternatives and also has significant potential to grow to meet rising demand.

Rising demand and higher prices have seen collection networks develop across many countries (although there are still a large number of countries where conditions have prohibited large scale collection so far). Our outlook for UCO supply is a range. The lower level is based on growth in countries with currently existing collection networks based on the outlook for GDP and population. The higher end of the range reflects the total amount of UCO which could be collected if all countries with some collection practices are able to reach per capita collection rates seen in countries with established collection. There is further upside potential if additional countries can overcome the barriers to establish large scale collection.

Diagram 7: Forecast global UCO supplies to 2030



- **Global supplies are forecast to reach between 5 and 10 billion gallons by 2030.**
- This will add between 1.4 and 6.1 billion gallons to supplies in 2022.
- Under the base case forecasts global collection rates are forecast to average 0.6 gallons per capita in 2030, under the higher, potential, scenario this reaches 1.25 gallons per capita.
- Asia is expected to remain the largest supplier globally and has significant potential to grow beyond the lower-level forecast.
- Latin America also has significant potential to increase supply beyond the lower-level forecast.
- Growth in collection in the U.S. is expected to be limited as collection is already high, although we expect some growth. In 2022 per capita collection reached 2.5 gallons per person, in 2030 we forecast that this will reach almost 3.2 gallons per capita in 2030. By 2030 UCO supply in the U.S. is forecast to reach around 1.1 billion gallons.
- If all countries overcome the barriers to setting up collection networks, the total available supplies of UCO could increase by a further 4-7 billion gallons, bringing the full global potential to around 17 billion gallons.

Concluding remarks

Supplies of UCO are expected to rise globally from 3.7 billion gallons in 2022 to between 5 and 10 billion gallons by 2030. There is further potential to increase volumes if more countries establish collection networks but overcoming the barriers to reach a sustainable market size may require incentives and support beyond healthy market prices.

To unlock additional supplies, investment is needed in collection networks. Higher prices have been sufficient to see increased UCO collection in some countries. However, other supports may also be needed. A key way to improve collection networks is for governments to enforce regulations over the disposal of waste oils.

Potential risks to the outlook are:

- Poor infrastructure. As the collection of UCO depends largely on trucks, the logistics and infrastructure in a country can have a significant impact on how viable it is to establish a collection network. This is a major barrier to overcome in lower income countries.
- Changes in tastes. Some countries are seeing a shift in tastes away from fried foods towards, reducing potential volumes which could be collected.
- Policy changes. If governments limit the use of UCO, we could see demand reduced. A possible outcome of this is prices may fall and the incentives to increase supplies will decline. However, this may also be an opportunity for markets without limits to take supplies from other markets.
- Fraud. If governments become concerned that fraud in the UCO sector is leading to large volumes of non-waste oil being sold as UCO we may see UCO banned from use.
- Stricter certification. Concerns over fraud in the UCO market has already seen a move from certification bodies to increase auditing. It is possible that if the administrative burden increases, collectors or suppliers of UCO will cease to supply the market or look for easier markets to enter, thus restricting the volume available to some markets.

Opportunities:

- There is significant potential to increase collection rates across the world. Many countries currently collect only a small proportion of the total volume of UCO created, with the right support and incentives, collection networks could be developed as we have seen in other countries over recent years.
- Many governments support the better regulation of waste oils. While some have struggled to enforce these regulations, we have seen many countries seek to prevent the recycling or dumping of UCO over recent years.

ⁱ LMC International specializes in global economic and market analysis of agricultural feedstocks and their major end products, with a focus on biofuels. LMC is fully owned by GlobalData Plc.

ⁱⁱ UCO conversion assumes 293.5 gallons per metric ton.

ⁱⁱⁱ YG is distinct from UCO as it has been rendered. YG is comprised of UCO and often contains rendered low quality animal fats such as tallow, poultry or lard. The rendering process heats the grease to a temperature for a specified period of time to sterilize the product.

^{iv} UCO includes yellow grease (YG). This is only relevant in the U.S.

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