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March 15, 2023

Cheryl Laskowski, Branch Chief
Low Carbon Fuel Standard Program
California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: World Energy Comments on the February 22, 2023, LCFS Public Workshop

Dear Ms. Laskowski:

World Energy values the opportunity to provide comments on the February 22, 2023, Low Carbon Fuel Standard (LCFS) Program: Public Workshop on the Potential Regulation Amendment Concepts. The LCFS remains an important policy to California and the renewable fuel sector with its key role in accelerating California's transition to cleaner transportation.

World Energy is one of the largest and longest-serving advanced clean energy suppliers in North America. It is one of the country's largest producers of renewable diesel. World Energy was the first commercial producer of sustainable aviation fuel (SAF) and remains the only commercial producer of SAF in the Western Hemisphere at our facility in Paramount, CA which is in the final stages of conversion from a petroleum refinery to a 100% renewable fuels bio-refinery. When completed, World Energy's Paramount facility is projected to increase production capacity to approximately 350 million gallons of low carbon fuels per year.

World Energy would like to share the following comments in response to the workshop on February 22:

2030 Compliance Target

While World Energy supports CARB's increase to at least a 30% reduction in carbon intensity (CI) by 2030, we urge staff to consider further increasing this goal. We request that CARB look closely at the scenarios that are currently being modeled by ICF International, which show that a 30% target is readily achievable given almost no new market innovations or entrants. Since the LCFS marketplace was created to spur such innovation, the targets should be set in at a level that will continue to draw investor interest. From the analysis, it appears that this level is above 30%. Without newly ambitious targets, the current credit glut will continue to trouble the marketplace and credit reduction opportunities will be missed.

While CARB has indicated interest in pursuing an acceleration mechanism, this mechanism would likely function best "on the margins", rather than a crutch that would be immediately needed to set the aggressive targets that are called for today. Allowing an acceleration mechanism to play this role would require many years of low LCFS credit prices before the compliance curve would be sufficiently rectified.

Step Down and Acceleration Mechanism

With the above rationale, we are encouraged to see the inclusion of a proposed step down in the compliance curve. This immediate signal will be critical for shoring up the current credit glut.

World Energy is also supportive of an acceleration mechanism, with the above-noted concerns that it should not be used in replacement for an ambitious 2030 target. With reference to our previous comments provided for the November 9, 2022, LCFS Workshop, we support the acceleration mechanism as it will ensure that the LCFS will reflect the complexities of the quick-changing market. This will remove the need for the LCFS to constantly undergo the dynamic process of rulemakings while still ensuring the maximum carbon reductions are achieved.

No Limit on Crop-based Feedstocks

As noted in our previous comment letters, we continue to think that a cap on crop-based

feedstocks is unwarranted at this juncture. We support the previous in-depth comments made by Clean Fuels Alliance America and the California Advanced Biofuel Association. The ILUC process was created using an expert working group over the course of several years to account for the exact concerns that CARB has raised. If CARB continues to believe that there is a problem above and beyond what is captured by ILUC, we encourage a follow-on expert working group be convened separate from and subsequent to the current rulemaking.

World Energy routinely receives expert feedstock analysis from resources such as LMC's Waste Oils & Fat report,[1] as well as LMC's Oilseeds & Oils report.[2] These resources are available for a subscription fee, but we are unable to provide them to the public record without violating the license agreement. If CARB would like to be well-informed of current market dynamics in feedstock markets, we would encourage a subscription for your internal use.

We are also attaching an LMC report that was conducted for the Advanced Biofuels Association, which shows (on Page 5, Diagram 2) billions of gallons of excess feedstock capacity through 2025.

Avoided Methane Credit for Hydrogen

World Energy supports CARB's intention of directing RNG into hydrogen as an end-use product. It is our goal to only use biogenic feedstock, such as RNG, in our steam methane reformer (SMR) to bring the lowest carbon hydrogen possible to the market. By 2025, we will produce a total of 180,000 kilograms of hydrogen per day, with 60,000 kilograms available on the market and at our publicly available fueling station. This will be produced on-site at our Paramount, CA facility.

We would like to seek clarification from CARB staff regarding the phase out of avoided methane emissions and its potential impacts to hydrogen. It is obvious that while CARB is proposing to phase out avoided methane credit from RNG pathways, the treatment of avoided methane for hydrogen production is less clear.

Book-and-Claim

World Energy is pleased to see the proposal to allow book-and-claim for hydrogen production. This will send a market signal to producers and investors while encouraging

1 https://www.lmc.co.uk/reports/waste-oils-fats-report/
2 https://www.lmc.co.uk/reports/oilseeds-oils-report/

the greater adoption of low CI hydrogen. As we pursue our hydrogen production goals, it is our priority to pursue the lowest carbon hydrogen possible. Hydrogen via book-and-claim will allow World Energy to apply the attributes of the lowest carbon hydrogen to our SAF and RD, thus creating even more investor interest in our products which will target hard-to-abate sectors. This type of investment signal will allow World Energy, and other companies like us, to increase our production volume for sectors like aviation, rail, maritime and heavy-duty trucking.

Hydrogen Calculator

We appreciate CARB's efforts to simplify the calculation of CI by building a standardized structure to simplify reporting and calculations for hydrogen production. It appears that only half (the SMR portion needed by World Energy) is currently functional. Also, the instruction manual indicates that the RNG B&C FPC used must be identified (Item 3.4) and the CI of the pathway (Item 3.5) are inputs for the calculator. If it is CARB's goal to broaden the support and supply of hydrogen over RNG with different and extended standards for B&C RNG production of hydrogen, this structure limits the flexibility of hydrogen SMR production to match the limitations of RNG pathways.

It is unclear what establishes the Maximum Matchable Quantity (4.5) and Quantity Matched (4.6) that are mentioned in the instructions, but not found in the calculator. (Additionally, 4.7, 4.8, and 4.11 are also missing). As mentioned, it is likely that World Energy will run our biorefinery fuel gas that is internally generated into the SMR as well as purchase RNG. This will create a feed that will be a mix of methane (CH4), ethane (C2H6), and propane (C3H8). It would be a great addition if this calculator could ultimately handle a typical mix of these feedstocks and integrate with the new renewable diesel calculator that CARB is planning.

World Energy thanks CARB for its work in updating the LCFS program and engaging stakeholders throughout the rulemaking process. We look forward to future and ongoing opportunities to provide feedback and support.

Sincerely,

Leeor Alpern
Senior Director of Government Relations and Public Affairs

The Outlook for Global Lipid Feedstocks to 2025

Prepared for:

Advanced Biofuels Association
Washington, DC

February 2023

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LMC Outlook for Lipid Feedstocks to 2025

Rationale for the Study

In December 2021, LMC International[1] submitted a report to EPA assessing the lipid feedstock outlook to 2030 with the goal of answering the critical question: *Will there be enough lipid feedstock to meet Advanced Biofuels Association goals for biomass-based diesel (BBD)?* The results of that study indicated that lipid feedstock for at least 9 billion gallons of BBD would be available to the U.S.[2]

Here we examine the ways in which short-term lipid supply to 2025, and in particular the supply of RFS-approved feedstocks, has been affected by external factors. We explain how they change our forecast for 2025 compared to the forecast in the 2021 report. In this analysis we have concluded that forecast supplies of lipid feedstocks in 2025 will be higher than forecast in the 2021 report.

Key conclusions

SUPPLY:

- **Contrary to some expectations, market factors of the last year have *increased,* not reduced, our forecast of the global supply of all lipid feedstocks[3] in 2025.**
  (This conclusion is the result of extensive, in-depth analysis of the impact of many market factors, outlined below.)
- The revised total forecast of supply for all uses is 290 million metric tons – up by 3.7 million metric tons compared to our 2021 forecast, equivalent to over 1 billion gallons RD[4].
- Of this total, global supply of RFS-approved lipid feedstocks has risen to 149 million metric tons in 2025 – up by 10.3 million metric tons from the previous report, equivalent to almost 3 billion gallons RD.

DEMAND:

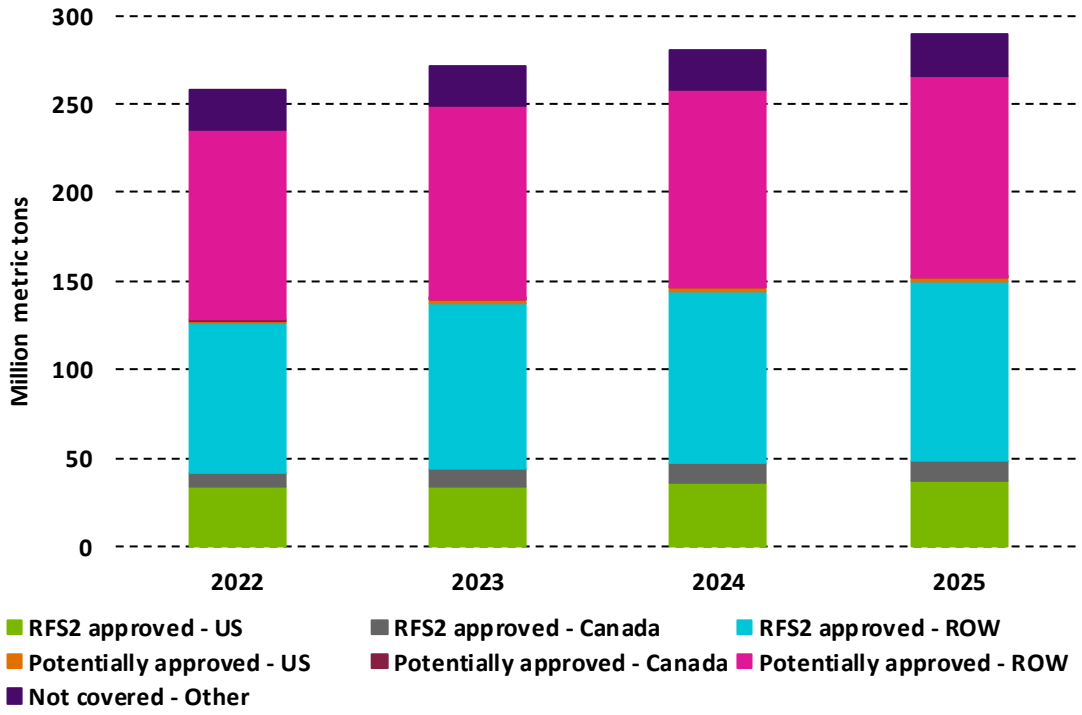
- First, we forecast global demand for lipids for foods and industrial uses, then the demand for biofuels in four countries other than the U.S. with strong environmental biofuel policies[5]. The resulting forecast: Global demand for lipids for these uses in 2025 is projected at 222 million metric tons.
- **From the 290 million metric tons of total global lipid supply, this leaves 68 million metric tons available for use in biofuels in the U.S. and elsewhere (other than the four countries) – *equivalent to over 19 billion gallons of RD*.**

CONCLUSION:

- **Based on LMC's latest forecasts of supply and demand to 2025, feedstock supplies available for use in the U.S. are more than enough to allow a significant increase in U.S. BBD demand, *after accounting for food*.**

We include all lipid sources in our analysis to form a full picture of the global market[3,4], separating RFS-approved and other feedstocks. Diagram 1 presents LMC's latest forecasts.

Diagram 1: Global oils and fats supply forecasts, 2022-2025



Key influences on lipid supply in 2022

- The most important development was **Russia's invasion of Ukraine**. Immediately it cut sunflower oil supplies from Ukraine, the world largest exporter, and the effects will linger beyond 2025, but it is not approved as a feedstock in the RFS; therefore, sunflower oil does not feature in the supply-demand balance for U.S. BBD.

- Other major negative consequences of Putin's war include forcing up diesel and fertilizer prices. In the case of diesel, that cloud has a silver lining in that **high diesel prices** support the prices of BBD, and these feed into BBD feedstock prices, stimulating their supply.

- The **leap in fertilizer prices** also has a silver lining. Higher fertilizer prices increase the attractions of soybean's nitrogen-fixing properties, and this promotes the planting of soybeans at the expense of grains.

- **On balance, Russia's invasion has increased the prices of oils and fats, which support their production, and boosted the planting of soybeans as a nitrogen-fixing crop.**

- A significant factor behind a generally disappointing 2022 crop was the persistence of **La Niña**. This reduced oil crop yields through a combination of droughts in the Americas and excessive rainfall in eastern Asia.

- Looking ahead, the **Oceanic Niño Index cycle** is now turning. **The return of U.S. soybean yields to their long-run trend will add 4.5% to production.** There will be further upside potential if an **El Niño** appears, lifting yields further. **Canola will benefit similarly**.

- The use of canola as a feedstock for RD has now been approved by the EPA. This opens a significant source of supply to meet growing U.S. capacity.

- Among the other vegetable oils approved as RFS feedstocks, very little has happened to change the forecasts from the volumes estimated in 2021.

- The world's largest source of vegetable oils is palm oil, which is not an RFS-approved feedstock. Palm oil production has been held back by difficulties in recruiting labor for harvesting and, more generally, by a sharp slowdown in new plantings. However, as with sunflower oil, problems with palm oil production do not affect the supply-demand balance for RFS-approved feedstocks.

- **The biggest single boost to the supply of feedstocks approved in the RFS arises from fats and greases that are not used significantly for food.** The output of most fats and greases has not been affected by the turmoil caused by Russia. Animal fats are a by-product of meat rendering and their availability changes very gradually. Distillers' corn oil supply is a function of North American corn ethanol output, which is governed by mandates.

- The non-food lipid that responded strongly to higher vegetable oil prices has been used cooking oil. The **collection and export of UCO** in Asia, led by China, have grown rapidly, even though Chinese catering establishments have struggled with repeated lockdowns. As pandemic restrictions continue to be lifted this should allow further growth in the coming years.

Lipid supply outlook to 2025

Taking these factors into account leads to these results for supply:

- The key contributors to the increases in forecasts of RFS-approved worldwide supply were those affecting soybean oil, canola oil, and used cooking oil (UCO). The two oils whose 2025 estimates were lowered were sunflower and palm oils, which are not RFS-approved.

- Focusing on the RFS-approved feedstocks, the primary reason for the higher soybean and canola projections in 2025 was the end of La Niña, which will enable yields to regain their long-run trends. A further influence for soybeans is its benefit as a nitrogen-fixing crop. For UCO, rising fats prices promoted higher collection rates, with China leading the way.

- The latest forecasts of the supply of the three RFS2-approved lipids, which drive the increase in forecasts for 2025, add a combined 4.6 million metric tons to U.S. and Canadian supply and 10.1 million metric tons to world supply that year.

- Sunflower oil output is the victim of Putin's war, while palm oil is suffering labor shortages.

- **Our forecast of global lipid supply has increased from 286 million metric tons in our 2021 report, to 290 million metric tons in 2025, up by 3.7 million metric tons, equivalent to over 1 billion gallons RD.**

- **Of this total, RFS-approved lipid feedstock supply has risen to 149 million metric tons in 2025, up by 10.3 million metric tons, from 139 million metric tons in our 2021 report, equivalent to almost 3 billion gallons RD.**

Key influences on lipid demand in 2022

Since 2021, there have been a number of changes to global biofuels policy that could impact demand for lipids over the next three years.

We focus on biofuel demand in Canada, Brazil, the EU and UK, outside of the U.S., as this demand is seen as strong as it is primarily based on lowering carbon emissions rather than supporting domestic agriculture.

- Both Canada and Brazil have increased targets in the last year. Canada delayed the implementation of their Clean Fuel Standard, but increased the goals for 2030, which is expected to lead to higher biomass-based diesel demand by 2025.

- In Brazil, the planned increase to biodiesel blending mandates has been brought forward. The nationwide blend will rise from 10% to 15% in March 2023, increasing demand for lipid-based fuels in the short term.

- The EU on the other hand has seen several countries roll back mandates in 2022 and 2023 in response to high prices and food scarcity concerns driven by the war in Ukraine.

Lipid demand outlook to 2025

Taking these factors into account leads to these results for demand:

- Total demand for lipids from biofuels in the four key countries is forecast to reach 33.3 million metric tons in 2025, 1.6 million metric tons higher than our previous forecast.

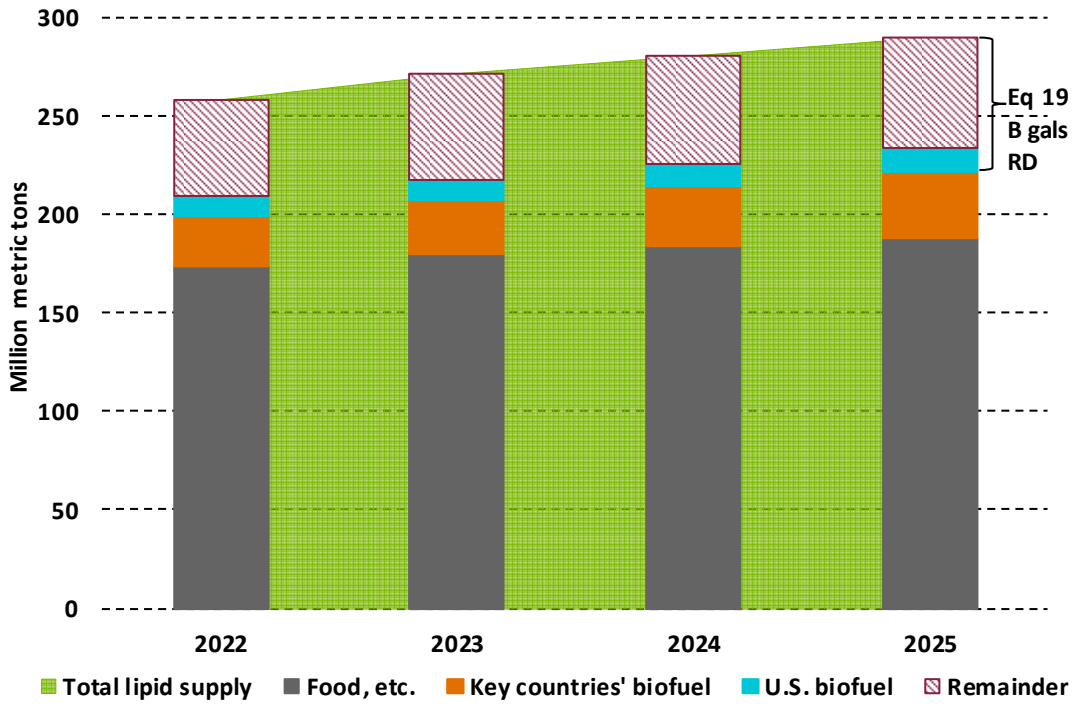
- Global demand for non-biofuel end uses (food, feed, and chemicals) is forecast to reach 188 million metric tons in 2025 – this is unchanged from last year.

- **Accounting for global demand for lipids from food as well as industrial uses globally and biofuels in four countries[5] other than the U.S. with strong environmental biofuel policies, global demand for lipids is in 2025 estimated at 221 million metric tons.**

- **This leaves 68 million metric tons of lipid supply available for use in biofuels in the U.S. and elsewhere, equivalent to over 19 billion gallons of RD.** (This includes the current outlook for BBD use in the U.S. in 2025). **This is an additional 2.5 billion gallons of RD compared the same calculation for 2022 lipid supply.**

➢ **Based on LMC's forecasts of supply and demand to 2025, feedstock supplies available for use in the U.S. are more than enough to allow a significant increase in U.S. BBD demand, after accounting for food.**

Diagram 2: Global lipid market forecast to 2025, supply vs. demand



Note: U.S. biofuel lipid demand is LMC base case forecast, based on current policy outlook.

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[1] LMC International specializes in global economic and market analysis of agricultural feedstocks and their major end products, with a focus on biofuels.

[2] Available lipid supplies are considered after taking into account the global demand for lipids for foods and industrial uses, and also the demand for lipids in biofuels in four countries other than the U.S. that have a high demand for biofuels[5].

[3] We include all oils, even if not approved for the RFS or other biofuel policies, such as palm, because they are a significant source of vegetable oil for a range of end uses around the world. Therefore, it is essential to include all oils when evaluating total global demand.

[4] The exact amount of lipids required for biomass-based diesel will depend on the type produced, the feedstock, and the technology used, as conversions vary with each factor. To put everything on a comparable basis, we present volumes of biofuel per volume of lipids in renewable diesel (RD) equivalents.

[5] We assess the requirement for lipid feedstocks to fulfill biofuel policies in four other markets, the EU, UK, Brazil, and Canada. These markets all have strong biofuel policies based on environmental targets that do not get amended easily. Given their policies and incentives, they represent competition for lipid feedstocks for the U.S., and bidding supplies away from them will be costly.