DIAMOND GREEN DIESEL

March 23, 2022

Anil Prabhu, Ph.D.
Manager, Fuels Evaluation Section
Transportation Fuels Branch
California Air Resources Board
1001 I street
Sacramento, CA 95814

Re: Diamond Green Diesel LCFS Tier 2 Pathway Application No. B0251 Response to Comment

Dear Mr. Prabhu:

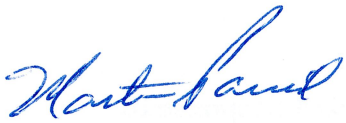
Diamond Green Diesel (DGD) provides this response to the comment letter submitted by Mr. Joshua Kehoe, dated March 15, 2022. The questions raised in the comments surrounded the percentage of finished product transported by rail versus ocean-vessel as well as which results in a higher carbon intensity (CI). As noted in the pathway report, DGD evaluated the CI impact of all routes by modes of transportation that were used during the pathway period and applied the most conservative CI impact to all finished fuel for all feedstocks. Therefore, the mode of transport for any given feedstock is always assumed to be the highest of the routes and modes of transportation evaluated. CARB does allow for either a weighted-average transportation finished fuel transportation CI evaluation or for the applicant to use the most conservative approach. Using the evaluation method described, DGD has chosen to use the most conservative approach.

In response to the comment regarding the level of redaction, DGD understands that per §95488.7(d)(5), CARB posts the pathway application only after a final check is completed to ensure it meets all requirements for certification, including the requirement to provide documents for public review in accordance with 17 CCR § 95488.8(c). As the application package was posted by CARB, we understand that CARB did not identify a concern regarding the level of redaction, but that CARB has requested that DGD respond to the comment received by reconsidering whether additional information can be disclosed without jeopardizing trade secret protection. In preparing the redacted version of the application for public review, DGD followed the requirements of 17 CCR § 95488.8, which allows all information meeting the definition of a "trade secret" under Cal. Gov't Code §6254.7 to be designated as Confidential Business Information. A trade secret includes, but is not limited to, "any formula, plan, pattern, process, tool, mechanism, compound, procedure, production data, or compilation of

information which is not patented, which is known only to certain individuals within a commercial concern who are using it to fabricate, produce, or compound an article of trade or a service having commercial value and which gives its user an opportunity to obtain a business advantage over competitors who do not know or use it." While DGD maintains that the public review document was appropriately redacted, we enclose a revised public review document by way of response to the comment received.

DGD appreciates the opportunity to respond to the comment. We respectfully request that CARB certify the fuel pathways listed in application No. B0251.

Sincerely,



Martin Parrish
Senior Vice President, Alternative Energy & Project Development

Attachment: DGD Revised Public Review Document

Attachment: DGD Revised Public Review Document

For questions concerning the redacted confidential business information please contact:

Jennifer Bond
One Valero Way, San Antonio, TX 78249
(210) 345-4239
Jennifer.bond@valero.com

CBI = Confidential Business Information has been Redacted by the Applicant

PART 2: Diamond Green Diesel
CARB LCFS FEEDSTOCK PATHWAY REPORT
DARLING SETTLED UCO SOLD TO DGD

Prepared for and by:
Diamond Green Diesel LLC
14891 Airline Drive
Norco, LA 70079
USA

Date: February 23, 2022

Executive summary

The California Air Resources Board approved the original LCFS regulation in April 2009 as a discrete early action measure under the California Global Warming Solutions Act of 2006 (AB 32). In addition, the Board subsequently approved amendments to the LCFS in 2011, 2015, and in late 2018.

In a joint venture called Diamond Green Diesel LLC (DGD), Diamond Alternative Energy LLC, a subsidiary of Valero Energy Corporation, partnered with Darling Ingredients Inc. (Darling) to build a renewable diesel refinery adjacent to the Valero St. Charles Refinery (VSCR), owned by Valero Refining-New Orleans, L.L.C. (Valero) and located in Norco, LA, to process rendered animal fat, recycled Used Cooking Oil (UCO), and other feedstocks into renewable diesel and renewable naphtha. In 2018, the Diamond Green Diesel plant was expanded from 160 million gallons to 275 million gallons per year of renewable diesel capacity.

Darling supplies UCO to the DGD plant. Darling has completed a review of the fossil energy used to process UCO at its US plants and has determined that the energy used to make settled UCO is less than the default values used in the CARB Tier 1 simplified calculators. This report accompanies an application for a user-defined US pathway for Darling's UCO that is sold to DGD and provides additional information on the data used for determining the carbon intensity (CI) requested.

The emissions calculated for the individual stages are summed to determine the fuel cycle CI. The results for the DGD renewable diesel and renewable naphtha pathways are shown in the following table. The new calculator presents the CI for multiple feedstocks simultaneously. Because of this feature of the calculator, the information for the CI of all feedstocks processed at DGD to make renewable diesel and renewable naphtha are included with this application. Finally, there are two changes to the Tier 1 calculator to correct the errors in the energy density and the hydrogen emission factors, which were approved by CARB in the 2019 DGD pathway application process.

Table 1: Lifecycle GHG Emissions – DGD Renewable Diesel and Renewable Naphtha from Multiple Feedstocks

Proposed Carbon Intensity, gCO2e/MJ	
Feedstock	**CI**
Soybean Oil	60.13
Corn Oil	27.26
UCO1	19.64
UCO2	17.95
Tallow1	31.77
Tallow2	42.48

Renewable Diesel and Renewable Naphtha will receive the same carbon intensity by feedstock.

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Introduction

In a joint venture called Diamond Green Diesel LLC (DGD), Diamond Alternative Energy LLC, a subsidiary of Valero Energy Corporation (Valero), partnered with Darling Ingredients Inc. (Darling) to build a renewable diesel refinery adjacent to the Valero St. Charles Refinery (VSCR), owned by Valero Refining-New Orleans, L.L.C. (Valero) and located in Norco, LA, to process Used Cooking Oil (UCO), animal fat (also called tallow), corn oil, and other feedstocks into renewable diesel and renewable naphtha.

The renewable diesel and naphtha sold by DGD is made from triglycerides and fatty acids from UCO, animal fats, and corn oil. The DGD plant uses CBI Process to hydrogenate the triglycerides and the free fatty acids in the feedstocks. The resulting paraffins are then isomerized to produce renewable diesel. The light fractions from the isomerization process are removed and sold as fuel gas, propane, or naphtha. The site and plant are shown in the following figure.

For 2019, the California Air Resources Board (CARB) has developed new simplified calculators for determining the CI of transportation fuels. The new calculator for biodiesel and renewable diesel is much more flexible than the CA GREET 2.0 Tier 1 calculator. The new calculators are required to be used from January, 1, 2019 and presents the CI for multiple feedstocks simultaneously. It also presents a CI for naphtha and propane that are co-produced with the renewable diesel. Because this calculator processes all available feedstocks simultaneously, the UCO feedstocks cannot be submitted separately from the tallow and corn oil feedstocks. As such, all currently processed feedstocks are included in calculator.

For this provisional pathway report, DGD is using the Darling settled UCO plant rendering energy determination to create a Darling Settled UCO pathway (UCO2) and a standard UCO pathway for all UCO not supplied by a Darling settled UCO plant (UCO1). This report provides additional information on the data used to determine the CI of the expanded Diamond Green Diesel Darling Settled UCO and standard UCO products. The period of the analysis is October 2018 through June 2020, which corresponds to the period post-expansion of the DGD plant. Darling and DGD are requesting a joint US user-defined carbon intensity pathway for the settled UCO that Darling supplies to DGD.

Figure 1 Diamond Green Diesel

Model Set-Up

The simplified calculator used was downloaded from the CARB LCFS website and is identified as DGD Tier1 with Darling UCO2.xlsm.

The BDRD calculator is set up as follows:

1. All feedstocks use the US region for the source of the feedstock.
2. All feedstocks use the standard values for feedstock production emissions.
3. The Regional Electricity mix for the renewable diesel plant is 13-SRMV Mix1.
4. The regional crude oil mix is US Average Crude
5. The regional natural gas source is US Average NG.

Other model inputs are entered on other sheets in the model. These are described in the following sections.

Feedstocks

Each feedstock for the plant is entered on a separate sheet in the model. For DGD the feedstock data is entered on the following sheets.

- Soy Oil
- CornSorghum Oil
- UCO1 (UCO from CBI suppliers or CBI other UCO plants)
- UCO2 (UCO from CBI Settled only UCO plants)
- Tallow1 CBI sourced tallow)
- Tallow2 CBI sourced tallow)

DGD has a monthly tank components inventory report that reports the closing inventory for the raw feed and process tanks. The beginning inventory is assumed to be the ending inventory from the previous month. All tanks can store a mixture of feedstocks. A separate report is used to account for the feedstock receipts for the month. All feedstocks inventories and receipts are reported in pounds. Feedstocks can be received by any combination of rail, truck, and barge.

Table 2: Feedstock Tank List Used to Determine Beginning and Ending Inventories

Tank Number	Tank Purpose
T-32-001	Feedstock Receiving Tank
T-32-002	Feedstock Receiving Tank
T-32-003	Feedstock Receiving Tank
T-32-004	Feedstock Blending Tank
T-32-005	Feedstock Blending Tank
T-32-006	Feedstock Blending Tank
T-32-007	Treated Feedstock Tank
T-32-008	Treated Feedstock Tank
T-32-009	Treated Feedstock Tank
T-32-014	Feedstock Receiving Tank
TK-1	CBI
TK-2	CBI
TK-3	CBI

CBI

All feedstock is tested for moisture content when received and must meet the specification of less than CBI. A conservative moisture content value of 0% is used for modelling (the lower the moisture content the higher the CI). Certificates of Analyses from the feedstock suppliers are available.

DGD sources feedstock from over CBI unique origins. DGD tracks the weighted average distance that the feedstock travels from the supplier to the plant based on source plant location or rail mileage data provided by the supplier. The collection of this information is detailed in the LCFS monitoring plan and the results of the analysis are included in the Calculator.

Soybean oil, Corn oil, UCO1, and Tallow1 are based on standard values for the feedstock production and all feedstock is sourced from the United States or Canada. UCO2 uses the CBI Settled only UCO rendering energy as described in the Part 1 Darling application. Tallow2 is CBI sourced animal fat.

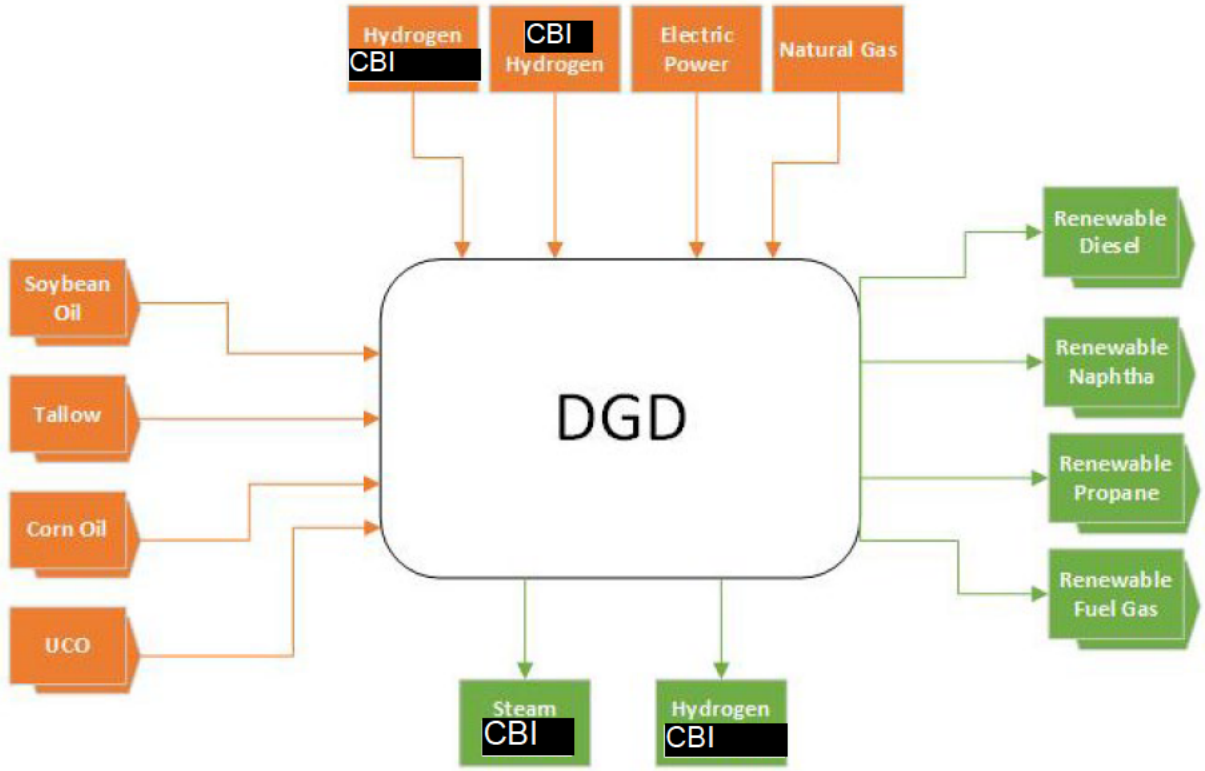
Renewable Diesel Production

The Diamond Green Diesel simplified process is shown in the following figure. In addition to the renewable diesel, the process produces a liquid petroleum gas vapor stream (LPG vapor), a liquid petroleum liquid stream (naphtha LPG), a purge gas stream, and a waste steam stream. All of the co-product streams are sold to CBI. The electric power, natural gas, and hydrogen are purchased from CBI and there are monthly invoices generated for those streams.

The utilities required to produce streams feeding or leaving DGD and the utilities being used to regenerate streams by CBI, such as the CBI stream, have agreed upon CBI and CBI (CBI) factors for the CBI and CBI service. These factors are used to calculate the additional power and natural gas usage and are included in the CBI . Invoices CBI are generated to account for the energy use to process these streams monthly.

Figure 2 shows the simplified process diagram for DGD. Inputs are in orange and outputs in green.

Figure 2 Diamond Green Diesel Simplified Process



Mass Inputs and Outputs

The feedstock processed is automatically computed by the calculator based on receipts and changes in the inventory levels. Process chemicals are a standard value in the new model (0.03 gCO2e/MJ).

The production of renewable diesel is determined in a similar manner to the feedstock, opening and closing inventories are recorded along with renewable diesel sales. The feedstock information is reported in pounds on the DGD component inventory report (mass) and the RD production is reported in gallons on the DGD tank inventory report (volume).

The yield is calculated from the input data. The co-product production is discussed later.

Energy Requirements

There are three energy inputs into the process: natural gas, electricity and hydrogen. They are purchased from CBI .

CBI produces invoices for the natural gas used by DGD. These are recorded in the calculator. The invoice unit is MM BTU (HHV) as required by the calculator. CBI [redacted]

The electricity invoice is reported in kWh and is entered into the calculator.

The plant receives CBI hydrogen streams from CBI, a CBI hydrogen stream and a CBI stream. CBI [redacted] he hydrogen invoice is the net hydrogen purchased. The hydrogen volume is reported at 60F, the standard value.

There are two corrections made to the CARB calculator with respect to hydrogen. The first relates to the energy content on the Fuel Specs sheet, which is reported as 290 BTU/Ft^3. This is the energy density at 32F and not 60F. This has been corrected by changing the values in cells B and C 24 on the Fuel Specs sheet to 274 BTU/Ft^3, the energy density at 60F.

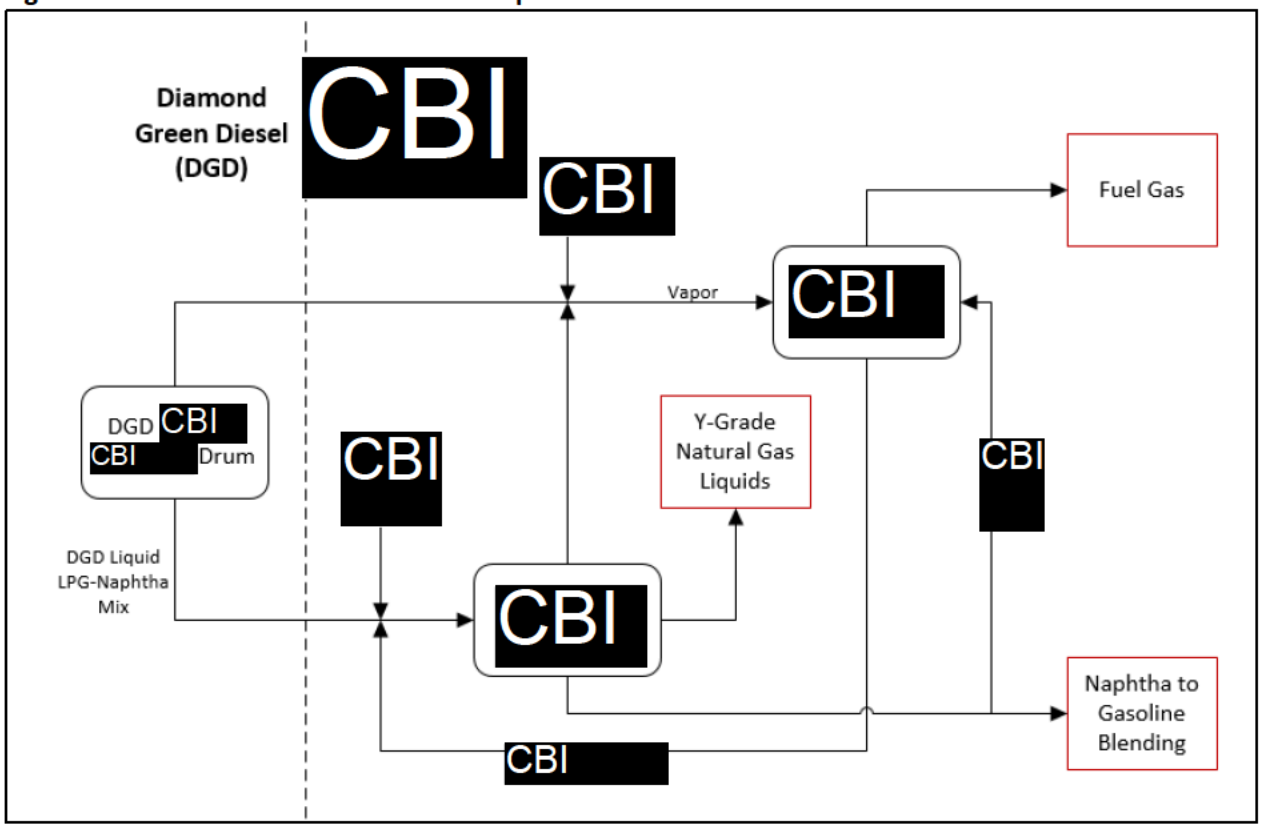
The second correction relates to the emission factor for hydrogen in the calculator which accounts for CBI miles of hydrogen transportation by pipeline. Removing this additional step reduces the hydrogen emission factor to CBI g CO2eq/MM BTU. This change is made in cell C37 on the EF Table sheet.

Both changes have been previously approved by CARB.

Co-Products

All renewable diesel plants produce a range of lighter hydrocarbons in addition to renewable diesel. These renewable co-products are usually separated into fuel gas, propane (LPG), and naphtha through a distillation process. In DGD's case, most of the separation is done at CBI. A simplified process flow diagram for the co-products is shown below.

Figure 3 Diamond Green Diesel Co-products



The output from the CBI units is sent to the CBI . The CBI produces a renewable diesel bottoms product (not shown) and two overhead co-product streams. One overhead stream (LPG Vapor stream) is mixed with similar streams from the CBI and the CBI and sent to the CBI . In that unit, all of the methane and ethane are extracted and sent to the fuel gas system. CBI The heavier material CBI) is sent back to the CBI where a saleable product, Y Grade Natural Gas Liquids, is produced as a CBI overhead product. This product is a mixture of CBI With the current configuration of the CBI facilities it is not possible to produce a specification grade renewable propane from the system.

The second stream from the DGD CBI (LPG- Naphtha Liquid) is also mixed with a similar stream from CBI and sent to the CBI . Any C2 minus material is stripped and eventually becomes fuel gas along with CBI . The rest of the CBI and all of the CBI goes to the Y Grade NGL stream. All of the CBI and CBI is sent to the naphtha for CBI . Like the Y Grade NGL stream, the naphtha stream is a mix of CBI The current configuration can't produce a separate renewable naphtha that would be suitable for CBI All of the streams between DGD and CBI are metered and recorded. The streams and meter details are outlined in the LCFS monitoring plan.

The co-product energy densities are described below. In order to calculate these energy densities, the individual component properties in the table below are used along with a water density of 8.3372 lbs/gallon.

Table 3: DGD Co-product Stream Properties

Component	HHV, btu/lb	LHV, btu/lb	LHV/HHV	Specific Gravity
Propane	CBI	CBI	CBI	CBI
i-Butane	CBI	CBI	CBI	CBI
n-Butane	CBI	CBI	CBI	CBI
i-Pentane	CBI	CBI	CBI	CBI
n-Pentane	CBI	CBI	CBI	CBI
Naphtha +	CBI	CBI	CBI	CBI

Naphtha

The naphtha stream is composed CBI. The quantity of naphtha produced is calculated from the mass flow rate of CBI and the composition of CBI.

The energy content is calculated from the CBI samples that are analyzed to determine the composition. Since the product is a mixture of components with well-established energy values the energy content can be determined with a high degree of accuracy. The monthly average compositions are the result of about 60 samples. The lowest monthly average value was used as the energy density for the naphtha stream.

LPG Liquid and Vapor Stream

The LPG liquid and vapor streams are composed of CBI components less a small portion that ends up in the CBI. The average composition is also reported monthly. The energy content is calculated and reported in the same manner as the naphtha stream.

Fuel Gas

Fuel gas or off gas is extracted from the DGD LPG vapor and liquid streams and sent to CBI. In addition to the fuel gas extracted from the LPG streams, there is a CBI gas stream that produces fuel gas that is sent to CBI. The total energy content of these streams is included in the CBI spreadsheet. The ratio of the LHV to the HHV of all three streams has been calculated to be 0.8989.

Renewable Diesel Transport

DGD distributes its renewable diesel by various modes from the plant to various facilities in CBI California. The customers buy the product FOB the Norco facility. The customers will use some combination of barge, ocean tanker, and rail to ship the renewable diesel to California. For ocean tanker shipments, the route is via the Panama Canal with a vessel that has a DWT of CBI tons, which when entered into the CA GREET 3.0 model results in a user defined emission factor of CBI g CO2eq/gallon mile. The shipping distance to the furthest destination is CBI miles to CBI, California. For rail or rail/barge combination shipments, the maximum distance from DGD by rail is to CBI California and the furthest distance by barge to a rail station is CBI miles. The three modes of transportation have been mapped in the following table.

Table 4: Renewable Diesel Modes of Transportation

Option:	Ocean Vessel	Rail Only	Combination Rail & Barge
Mode	Miles	Miles	Miles
2.20.a From RD plant to port/railyard by HDD Truck	CBI	CBI	CBI
2.20.c By Rail	CBI	CBI	CBI
2.20.d By Ocean Tanker (Define Tanker Size first)	User Defined	n/a	n/a
	CBI	CBI	CBI
Mileage to California	CBI	CBI	CBI
2.20.e By Barge	CBI	CBI	CBI
CI by MOT	**1.62**	**1.65**	**1.67**

To be conservative and allow for flexibility of transportation options, the route with the highest emissions is used in the calculator.

Tailpipe Emissions

The tailpipe emissions are the same for all renewable diesel fuels. This emission category calculates the methane and nitrous oxide emissions associated with the combustion of renewable diesel in the vehicle. The value in CA GREET 3.0 is 0.76 g CO2eq/MJ.

Indirect Land Use Change

Only soybean oil has an indirect land use change factor built into the Tier 1 Calculator of 29.10 gCO2e/MJ. This default value is used in the calculations. There are no indirect land use emissions associated with any of the remaining feedstocks.

Summary

The emissions calculated for the individual stages are summed to determine the fuel cycle CI. The results for the DGD renewable diesel and renewable naphtha pathways are shown in the following table. Renewable diesel and renewable naphtha receive the same CI for the same feedstock.

Table 5: Lifecycle GHG Emissions – DGD Renewable Diesel

Proposed Carbon Intensity, gCO2e/MJ	
Feedstock	**CI**
Soybean Oil	60.13
Corn Oil	27.26
UCO1	19.64
UCO2	17.95
Tallow1	31.77
Tallow2	42.48

Where:

- Soybean Oil is sourced from CBI
- Corn Oil is sourced from CBI
- UCO1 is UCO sourced from CBI
- UCO2 is UCO sourced from CBI
- Tallow1 is sourced from CBI
- Tallow2 is sourced from CBI

Contains Confidential Business Information

PART 1: Darling Ingredients Inc.
CARB LCFS FEEDSTOCK PATHWAY REPORT
DARLING SETTLED UCO SOLD TO DGD

Prepared for and by:
Darling Ingredients Inc.
5601 N MacArthur Boulevard
Irving, Texas 75308

Contact:
[redacted]

Date: September 15, 2021

Executive summary

The California Air Resources Board approved the original LCFS regulation in April 2009 as a discrete early action measure under the California Global Warming Solutions Act of 2006 (AB 32). In addition, the Board subsequently approved amendments to the LCFS in 2011, 2015, and in late 2018.

In a joint venture called Diamond Green Diesel LLC (DGD), Diamond Alternative Energy LLC, a subsidiary of Valero Energy Corporation (Valero), partnered with Darling Ingredients Inc. (Darling) to build a renewable diesel refinery adjacent to Valero's St. Charles Refinery in Norco, LA, to process Used Cooking Oil (UCO), animal fat (sometimes called tallow), corn oil, and other feedstocks into renewable diesel fuel. In October 2018, the DGD plant was expanded from 160 million gallons to 275 million gallons per year of renewable diesel capacity.

Darling supplies UCO to the DGD plant. Darling has completed a review of the fossil energy used to process UCO at its US plants and has determined that it is less than the default values used in the CARB Tier 1 simplified calculators. This report accompanies an application for a user-defined US pathway for Darling's UCO that is sold to DGD and provides additional information on the data used for determining the carbon intensity (CI).

The results for the Darling to DGD UCO US pathway are:

Settled UCO	**Carbon Intensity (gCO_2e/MJ)**	**Standard UCO GHG Emission Factor (gCO_2e/lb oil)**	**Standard Oil Extraction Energy (Btu/lb oil)**
Greet 3.0 Default	6.56	90	1,073
Darling User-Defined US Pathway	4.87	[redacted]	[redacted]

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Introduction

In a joint venture called Diamond Green Diesel LLC (DGD), Diamond Alternative Energy LLC, a subsidiary of Valero Energy Corporation (Valero), partnered with Darling Ingredients Inc. (Darling) to build a renewable diesel refinery adjacent to Valero's St. Charles Refinery in Norco, LA, to process Used Cooking Oil (UCO), animal fat (sometimes called tallow), corn oil, and other feedstocks into renewable diesel fuel.

The renewable diesel sold by DGD is made from triglycerides and fatty acids from UCO, animal fats, corn oil, and other fats or oils. The DGD plant uses UOP's Ecofining Process to hydrogenate the triglycerides and the free fatty acids in the feedstocks. The resulting paraffins are then isomerized to produce renewable diesel. The light fractions from the isomerization process are removed and sold as fuel gas, propane, or naphtha.

With over 200 locations on five continents, Darling manufactures a wide range of products and customized specialty solutions for customers in the pharmaceutical, food, pet food, animal feed, fuel, bio-energy, fertilizer, and foodservice industries. Darling is the largest US independent[1] renderer with over 50 plants located throughout the US. Darling has [redacted] UCO-only plants which produce only settled UCO.

The [redacted] plant locations are listed in Appendix A, table 1.

Any of these facilities can sell UCO to DGD to produce renewable diesel.

The period of the analysis [redacted] Darling and DGD are requesting a joint US user-defined carbon intensity pathway for the settled UCO that Darling supplies to DGD.

UCO Feedstock Pathway and Future Expansion

Darling is requesting a single user-defined pathway for its US plants that only settle UCO and currently sell or have the potential to sell settled UCO to DGD. The single user-defined emission factor is weighted by each plant's sales to DGD. [redacted]

[1] Not associated with edible meat processing

Processing Raw Material into Used Cooking Oil

Raw UCO Collection

Raw UCO is collected from restaurants, stadiums, casinos, and industrial food manufacturing plants from indoor and/or outdoor containers (tanks, bins, and/or drums) located onsite at the collection source.

Trucks are routed to collect UCO from customers to optimize the trips and to make efficient use of each truck's capacity so that trucks return to the plant nearly full.

Darling transports the raw UCO directly to the processing plants or to a transfer station to simplify logistics and/or to aggregate raw material.

Transfer stations and their destination plants are listed in Appendix A, table 2.

Except for [redacted], the transfer stations are "docks"; the route truck originates from the transfer station, collects the raw UCO, and then either delivers the raw UCO to the plant or returns to the transfer station where the raw UCO can be aggregated by transferring it into another larger truck using onboard pumps. The fossil energy consumed in the truck-to-truck transfer is de minimis; therefore, adjustments to the calculations have not been made.

At [redacted], the raw UCO is received across a screen and transferred into a plant tank for a brief hold, typically less than a day, before being re-loaded into a tanker [redacted] The fossil energy invoiced [redacted], both natural gas and electricity, has been added to the energy used at the destination plant, [redacted].

[redacted]

Settled UCO

Once arriving at the plant, the raw UCO [redacted] is then transferred to a settling tank that is heated with steam either through coils or by direct injection and left to settle. Once settled, the water [redacted] withdrawn. [redacted]
Finally, the recovered UCO is put into finished product tanks.

A typical process flowchart is included in Appendix B.

[redacted]

[redacted]

Co-products/Waste Products

[redacted]

Solid wastes [redacted] are treated similarly to the liquid cuts. Either the food chunks are recovered as a co-product and sent to [redacted] with the rest of the trash. [redacted]

Wastewater is disposed of via the sewer, [redacted] may be disposed of through land application.

Quality Control

In-process and finished product tests are conducted on each batch. Several tests that may be done for each product include:

- FAC (pesticides)
- Free Fatty Acids (FFA)
- Insoluble Impurities
- Moisture
- Unsaponifiable Matter

The results of the analyses determine whether the product can be released for shipment [redacted]. Once released for shipment, UCO is loaded onto rail cars or trucks and sent to Darling's customers. As one of Darling's customers, the DGD plant uses the Darling UCO to produce renewable diesel.

Carbon Intensity Analysis

The fossil fuel consumption for each plant is calculated by dividing the metered energy by the UCO production for the [redacted] period [redacted] The usage is then converted into the CO_2 emissions corresponding to the quantity of each type of energy.

The calculations include:

- The regional electricity mix which is based on the location of the plant
- The regional natural gas source which is US Average NG
- Electricity and natural gas metered data from utility invoices
- [redacted] Production based on finished product sales taking into account changes in inventory, shipments, purchases, and in-process transfers. [redacted]

[redacted]Pounds sold to DGD, [redacted]

Raw Material Weight

The raw material received at the plant is weighed with certified scales before unloading.

Energy Requirements

There are two fossil energy sources, electricity and natural gas; they are delivered to each plant by public electricity and natural gas companies. Meters located on the utility lines at the supply point are owned and maintained by these companies. These local utility companies invoice the natural gas and electricity in amounts measured by these meters, which must meet applicable regulations for such purpose. The amounts taken from the invoices are used to calculate the fossil energy used in the plant. The unit for natural gas is million Btu's Low Heating Value (MM Btu - LHV) and the unit for electricity is kilowatt hours (kWh).

The meter readings include usages from all activities at the site, including administrative functions and plant/truck maintenance, over the entire time the plant is operating.

UCO Production

The UCO ready for shipment is stored in finished tanks. The UCO production for each month is determined from the sum of all shipments, adjusted for changes in inventory between the beginning and the end of each period and in-process material transfers. Tank levels are measured for changes in inventory. Finished UCO trucks are weighed over a certified scale. Railcars are either filled by transferring material from trucks and totaling their weights, or directly from storage and then the weight is gauged.

Energy Intensity Analysis

The UCO total energy intensity (EI) for each plant is calculated based on [redacted] as follows:

$$Total\ Plant\ UCO\ Energy\ Intensity\left(\frac{Btu}{lb}\right) = Plant\ UCO\ Natural\ Gas\ EI\ \left(\frac{Btu}{lb}\right) + Plant\ UCO\ Electricty\ EI\ \left(\frac{Btu}{lb}\right)$$

where:

$$Plant\ UCO\ Natural\ Gas\ EI\left(\frac{Btu}{lb}\right) = \frac{Invoiced\ Usage(MM\ Btu)\ *\ 10^6\ \left(\frac{Btu}{MM\ Btu}\right)}{UCO\ Produced\ (lb)\ *\ (1 - Moisture\ Content)}\ *\ 0.903\ \left(\frac{LHV}{HHV}\right)$$

- 90.3% is the LHV/HHV conversion from the CA-GREET RD/BD calculator.
- Moisture content is [redacted]

and

$$Plant\ UCO\ Electricity\ EI\ \left(\frac{Btu}{lb}\right) = \frac{Invoiced\ Usage(kWh)}{UCO\ Produced\ (lb)\ *\ (1 - Moisture\ Content)}\ *\ 3{,}412.141\left(\frac{kWh}{Btu}\right)$$

GHG Emission Factor Analysis

The Darling settled UCO CI is calculated from a weighted average of each plant's CI:

$$Darling\ UCO\ EGHG\ Emission\ Factor\ \left(\frac{gCO2e}{lb}\right) = \frac{\sum_{7\ UCO-only\ locations} Plant\ UCO\ EGHG\ Emission\ Factor * UCO\ shipped\ to\ DGD\ from\ that\ location\ \ (lb)}{\sum_{7\ UCO-only\ locations}\ UCO\ shipped\ to\ DGD\ from\ that\ location\ (lb)}$$

Where the UCO shipped is [redacted]

The GHG emission factor for each plant is calculated using 24 months of data from October 2018 to September 2020 as follows:

$$Plant\ UCO\ EGHG\ Emission\ Factor\ \left(\frac{gCO2e}{lb}\right) = Plant\ UCO\ Natural\ Gas\ GHG\ EF\ \left(\frac{gCO2e}{lb}\right) + Plant\ UCO\ Electricty\ GHG\ EF\ \left(\frac{gCO2e}{lb}\right)$$

where:

$$Plant\ UCO\ Natural\ Gas\ GHG\ EF\ \left(\frac{gCO2e}{lb}\right) = \frac{Plant\ UCO\ Natural\ Gas\ EI\ \left(\frac{Btu}{lb}\right)}{10^6\left(\frac{Btu}{MM\ Btu}\right)}\ *\ 73{,}424.19\frac{gCO2e}{MMBtu}\ (US\ Average\ NG)$$

and

$$Plant\ UCO\ Electricity\ GHG\ EF\ \left(\frac{gCO2e}{lb}\right) = \frac{Plant\ Invoiced\ Usage(kWh)}{UCO\ Produced\ (lb)\ *\ (1 - Moisture\ Content)} * Regional\ Electricity\ Mix\ \left(\frac{gCO2e}{kWh}\right)$$

Transportation of UCO to the Settling Plants

[redacted]

Summary

The emissions calculated for the individual plants are combined using a weighted average based on pounds shipped to DGD over the last twelve months to calculate the US UCO carbon intensity (CI). The result is shown in the table below. The calculations are included in the Darling UCO Tier 1 spreadsheet. Darling requests to use this value as the CI for all settled UCO shipped to DGD regardless of plant origin.

Settled UCO	Carbon Intensity (gCO_2e/MJ)	Standard UCO Rendering GHG Emission Factor (gCO_2e/lb oil)	Standard Oil Extraction Energy (Btu/lb oil)
Greet 3.0 Default	6.56	90	1,073
Darling User-Defined US Pathway	4.87	[redacted]	[redacted]

[redacted]

Appendix A: Darling's US UCO Plants by Location for CI Consideration

Table 1 - US Settled Only Plants used in the CI analysis

	Facility Name	Facility ID	Location	UCO Process
[redacted]				

Table 2 - Transfer Stations and Destination Plants

Transfer Location	Deliver to
[redacted]	

Appendix B: Typical Process Flow Diagrams for Settled UCO