CARB LCFS FUEL PATHWAY REPORT
RENEWABLE DIESEL

Prepared For:

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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. For 2019 CARB have developed new simplified calculators for determining the CI of transportation fuels.

The new calculator presents the CI for multiple feedstocks simultaneously. It can also present a CI for naphtha and propane that are co-produced with the renewable diesel. The new calculator does require input data in a different format than the previous CA GREET 2.0 Tier 1 and Tier 2 calculators.

The St. Bernard Renewables (SBR) biorefinery has commenced operations with production of commercial product beginning in June 2023. SBR is currently targeted to have processing capacity of about 1.1 million tonnes/year of raw materials, with full pretreatment capabilities. It will produce mainly HVO Diesel (Hydrotreated Vegetable Oil, commonly known as 'renewable diesel' in North America), with a production capacity of 306 million gallons per year. This report accompanies a CARB Provisional Application for a Carbon Intensity determination for the products produced by the plant.

SBR currently has pathways for soybean oil, canola oil, distillers corn oil, North American used cooking oil, North America tallow and south American tallow. This application is for six additional pathways, southeast Asia used cooking oil, central America used cooking oil, used cooking oil from Puerto Rico and the Cayman Islands, tallow from Australia and New Zealand, tallow from Mexico and tallow from the UK.

The results for the St. Bernard Renewables renewable diesel pathways are shown in the following tables.

Table ES- 1 Lifecycle GHG Emissions – St. Bernard Renewables Renewable Diesel from UCO

Feedstock	SEA UCO	CAM UCO	PR/Cay UCO
Stage	gCO_2e/MJ		
Feedstock Production	[redacted]	[redacted]	[redacted]
Fuel Production			
Indirect Land Use	0.00	0.00	0.00
Tailpipe Emissions	0.76	0.76	0.76
RD	31.78	24.19	27.30

Table ES- 2 Lifecycle GHG Emissions – St. Bernard Renewables Renewable Diesel from Tallow

Feedstock	ANZ Tallow	Mexico Tallow	UK Tallow
Stage		gCO_2e/MJ	
Feedstock Production	[redacted]	[redacted]	[redacted]
Fuel Production			
Indirect Land Use	0.00	0.00	0.00
Tailpipe Emissions	0.76	0.76	0.76
RD	54.63	29.76	28.50

TABLE OF CONTENTS

II

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

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. For 2019 CARB have developed new simplified calculators for determining the CI of transportation fuels.

The new calculator presents the CI for multiple feedstocks simultaneously. It can also present a CI for naphtha and propane that are co-produced with the renewable diesel. The new calculator does require input data in a different format than the previous CA GREET 2.0 Tier 1 and Tier 2 calculators.

The St. Bernard Renewables biorefinery has commenced operations with production of commercial product beginning in June 2023. SBR is currently targeted to have processing capacity of about 1.1 million tonnes/year of raw materials, with full pretreatment capabilities. It will produce mainly HVO Diesel (Hydrotreated Vegetable Oil, commonly known as 'renewable diesel' in North America), with a production capacity of 306 million gallons per year. This report accompanies a CARB Provisional Application for a Carbon Intensity determination for the products produced by the plant.

1.1 ST. BERNARD RENEWABLES LLC

St. Bernard Renewables LLC (SBR) is a 50-50 joint venture partnership between Eni Sustainable Mobility Spa and PBF Energy Inc. and is an operating biorefinery co-located with PBF's Chalmette Refinery in Louisiana (US). The biorefinery is using the Ecofining™ process developed by Eni in cooperation with Honeywell UOP.

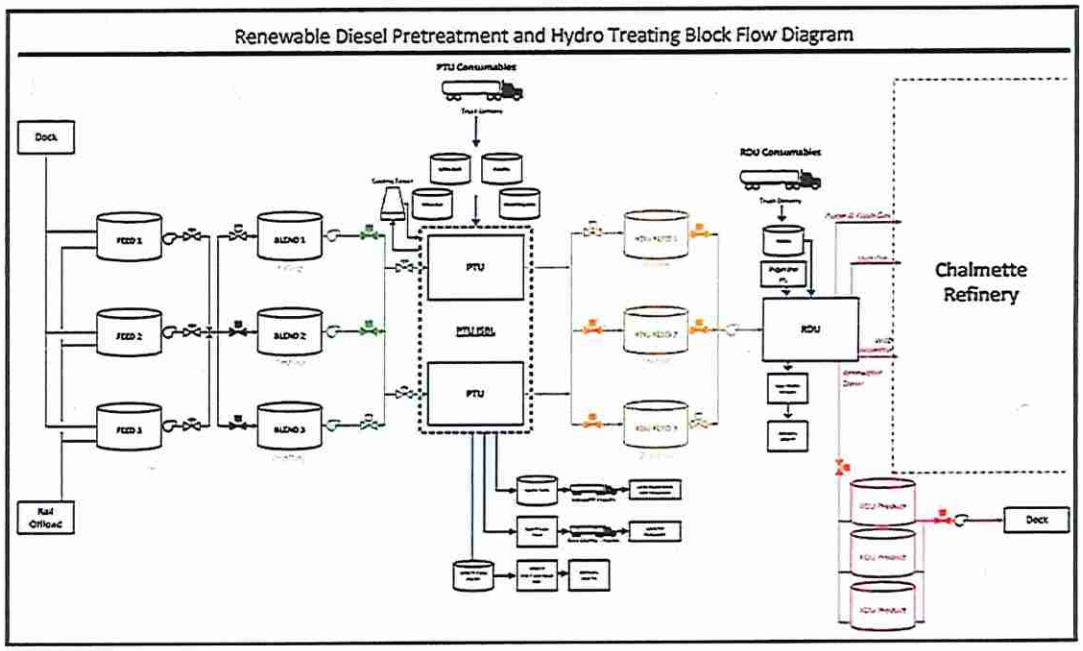
SBR operates as an independent entity with feed procurement and product distribution managed by a dedicated team working on behalf of the St. Bernard Renewables joint venture. [redacted]

The site and plant are shown in the following figure.

Figure 1-1 Aerial View – St. Bernard Renewables

The block flow schematic for the process is shown in the following figure.

Figure 1-2 Block Flow Schematic



Feedstock is pumped from storage through the pretreatment facility and then into the RDU and heated and mixed with recycled renewable diesel and hydrogen. The reactor/catalyst section of the process removes oxygen, reduces trace organic sulfur and nitrogen components to low levels, and includes an isomerization step to improve renewable diesel (RD) product cold flow properties, thus converting feedstock into a RD that meets ASTM D-975 product specifications for Ultra Low Sulfur Diesel.

A separation section removes fuel gas, propane, butanes, and naphtha.

1.2 Model Set-Up

The simplified calculator that has been used has been downloaded from the CARB LCFS website and is identified as the August 13, 2018-corrected version.

The values that are location dependent and are set with drop down menus are:

1. The plant zip code and places the plant in the SRMV eGrid and the model input is 13 SRMV Mix.[1]
2. The regional crude oil mix is US Average Crude
3. The regional natural gas source is US Average NG.

The facility purchases hydrogen from an industrial gas company. The CA GREET calculator uses the density of hydrogen at 32F. SBR is invoiced for Hydrogen at a reference temperature of 70F. The invoiced amount is converted to a reference temperature of 60F in cells I27:I28 of the RD-Production worksheet. The energy content of hydrogen in the calculator is set to

[1] https://www.epa.gov/egrid/power-profiler#/

274.37 BTU/ft^3 in cell B24 on the Fuel Specs sheet and all of the hydrogen inputs are reported at 60F.

The standard emission factor for hydrogen in the CA GREET calculator includes a hydrogen pipeline distance of 150 miles. In this case the hydrogen is received by pipeline from a facility that is [redacted] away. Using [redacted] as the pipeline distance the hydrogen emission factor becomes [redacted] g CO_2eq/MM BTU.

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

2. FEEDSTOCK

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

1. UCO3 – SEA
2. Others2 – UCO CAM
3. Others3 – UCO PR Cayman
4. Tallow3 – Aus/NZ
5. Tallow4 – MX
6. Others4 Tallow UK

There is feedstock storage at a [redacted] terminal nearby as well as at the SBR facility. Feedstock can also be received directly at the SBR facility. SBR has an inventory system that tracks all of the material into and out of the [redacted] facility and allocates the transportation information for all of the receipts to the shipments to the SBR facility based on the weighted average of the receipts and the inventoried materials.

Only spot measurements of the incoming feedstocks are done so the moisture content is conservatively set to zero for all feedstocks.

2.1 UCO3 SEA

This pathway is for used cooking oil imported from south-east Asia. User defined emission factors are used. The UCO is produced in Indonesia and has an emission factor [redacted] The inventory, receipts and processed quantities for this pathway are shown in the following table.

Table 2-1 Southeast Asia UCO Feedstock

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The transportation information is shown in the following table. The vessel size is [redacted] and the emission factor from CA Greet 3.0 for this size of vessel is [redacted] All of the feedstock is transported by all three modes of transportation.

Table 2-2 Southeast Asia UCO Feedstock Transportation

Month	SEA Tallow					
	Pounds Received Truck	Average Truck Miles	Pounds Received Ocean Tanker	Average Ocean Tanker Miles	Pounds Received Barge	Average Barge Miles
10-2023						
11-2023						
12-2023						
01-2024						
02-2024						
03-2024						
04-2024						
05-2024						
06-2024						
07-2024						
08-2024						
Total						

2.2 OTHERS2 UCO CAM

Used cooking oil from central America is the next new pathway. The UCO is produced in Central America and has an emission factor [redacted] The inventory, receipts and processed quantities for this pathway are shown in the following table.

Table 2-3 Central America UCO Feedstock

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The transportation information is shown in the following table. The vessel size is [redacted] and the emission factor from CA Greet 3.0 for this size of vessel is [redacted] All of the feedstock is transported by all three modes of transportation.

Table 2-4 **Central America UCO Feedstock Transportation**

Month	Central America UCO					
	Pounds Received Truck	Average Truck Miles	Pounds Received Ocean Tanker	Average Ocean Tanker Miles	Pounds Received Barge	Average Barge Miles
10-2023						
11-2023						
12-2023						
01-2024						
02-2024						
03-2024						
04-2024						
05-2024						
06-2024						
07-2024						
08-2024						
Total						

2.3 OTHERS3 UCO PR CAYMAN

This UCO is modelled as being collected in the Cayman Islands. The electricity grid is more carbon intensive on the Cayman Islands than in Puerto Rico. The calculated emission factor using the electricity grid for the Cayman Islands is [redacted] of UCO.

Table 2-5 **PR Cayman UCO Feedstock**

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The transportation information is shown in the following table. The standard value is used for the ocean tanker size and emission factor.

Table 2-6 PR Cayman UCO Feedstock Transportation

Month	Cayman UCO					
	Pounds Received Truck	Average Truck Miles	Pounds Received Ocean Tanker	Average Ocean Tanker Miles	Pounds Received Rail	Average Rail Miles
10-2023						
11-2023						
12-2023						
01-2024						
02-2024						
03-2024						
04-2024						
05-2024						
06-2024						
07-2024						
08-2024						
Total						

2.4 TALLOW3 – AUS/NZ

Tallow3 – Aus/NZ is tallow that is received from Australia and New Zealand. For the tallow, there is trucking from the rendering plants in Australia and New Zealand to the ports, ocean shipping from the ports to New Orleans where the tallow can be offloaded into the [redacted] terminal or 3rd party terminal and then delivered via barge or railcar to the SBR. The weights are recorded from the Bills of Lading. Transportation distances are assigned for each supplier based on their points of origin and a weighted monthly average calculated for the feedstock.

The calculated emission factor using the electricity grid for Australia is [redacted] of UCO. [redacted]

The tallow that has been received for the period of the application is shown in the following table.

Table 2-7 Aus/NZ Tallow Feedstock

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The CI Calculator is using Supplier data from three different sources in Australia and New Zealand. The majority of the Tallow originated from [redacted] but there was also Tallow sourced from plants around [redacted] We utilized supplier data to confirm the MOTs, routing and miles.

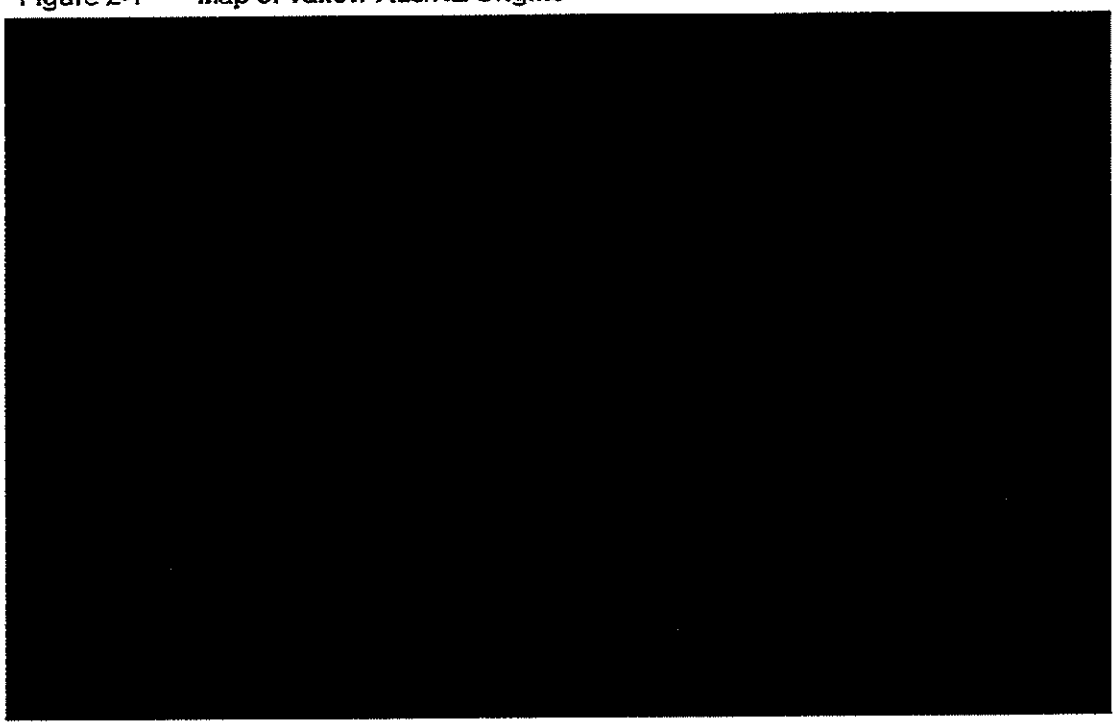
All of the tallow moves by the same modes of transport but the distances can change from month to month depending on the sources. Ocean Tanker sizes varied, ranging from approx. [redacted] The calculator uses a value of [redacted] taking into consideration variability in the future. Using this vessel size in the CA GREET 3.0 model produces and emission factor of [redacted]

Table 2-8 Aus/NZ Tallow Feedstock Transportation

Month	ANZ Tallow					
	Pounds Received Truck	Average Truck Miles	Pounds Received Ocean Tanker	Average Ocean Tanker Miles	Pounds Received Barge	Average Barge Miles
10-2023						
11-2023						
12-2023						
01-2024						
02-2024						
03-2024						
04-2024						
05-2024						
06-2024						
07-2024						
08-2024						
Total						

The below figure shows the approximate locations of the Rendering Facilities from which the Tallow originated, was processed and/or refined.

Figure 2-1 Map of Tallow-Aus/NZ Origins



2.5 TALLOW4 - MX

Tallow4-MX is shipped directly to St. Bernard Renewables from the suppliers' plant in Mexico. It is received by railcar. The weights are recorded from the Bills of Lading. Transportation distances are assigned for each supplier based on their points of origin and a weighted monthly average calculated for the feedstock. Only spot measurements of the incoming tallow are done so the moisture content is conservatively set to zero. The opening and closing inventories for the feedstock tanks are recorded and along with the feedstock receipts are used to calculate the feedstock processed.

The tallow that has all been received for the period of the application is shown in the following table.

Table 2-9 Tallow4-MX Processed

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

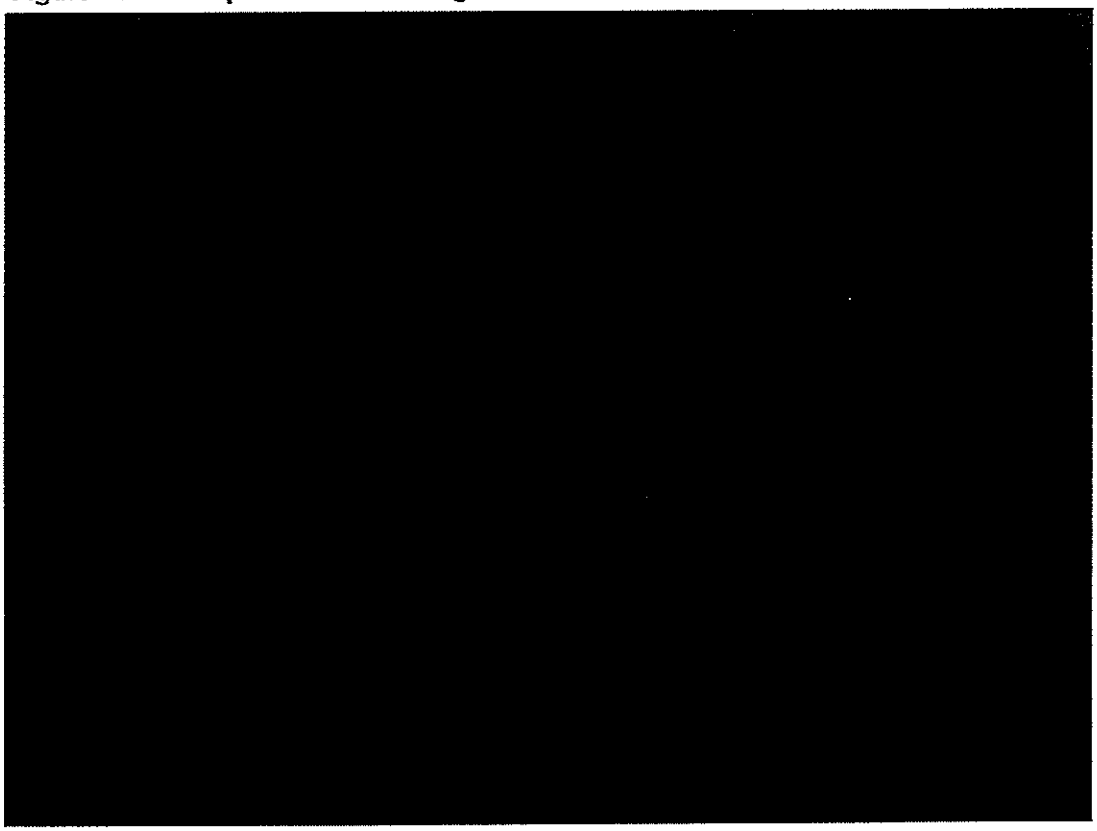
Table 2-10 Tallow4-MX Feedstock Transportation

Month	Mexico Tallow			
	Pounds Received Truck	Average Truck Miles	Pounds Received Rail	Average Rail Miles
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The Tallow-MX rendering emissions are calculated using the latest IEA data for electricity grid mix for the Mexico (Energy Statistics Data Browser – Data Tools - IEA).

The below figure shows the approximate locations of the Rendering Facilities from which the Tallow originated, was processed and/or refined.

Figure 2-2 Map of Tallow-MX Origins



2.6 OTHERS4 TALLOW UK

The UK tallow feedstock is shown in the following table. The emission factor is [redacted] which is calculated using the UK electricity mix from the IEA and [redacted]

Table 2-11 UK Tallow Feedstock

Month	Opening Inventory	Oil Received	Oil Processed	Closing Inventory
	pounds			
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

The feedstock transportation is shown in the following table. The vessel size is [redacted] ad the emission facto from CA GEET 3.0 for this size vessel is [redacted]

Table 2-12 UK Tallow Feedstock Transportation

Month	UK Tallow					
	Pounds Received Truck	Average Truck Miles	Pounds Received Ocean Tanker	Average Ocean Tanker Miles	Pounds Received Barge	Average Barge Miles
10-2023						
11-2023						
12-2023						
01-2024						
02-2024						
03-2024						
04-2024						
05-2024						
06-2024						
07-2024						
08-2024						
Total						

3. RENEWABLE DIESEL PRODUCTION

The production of renewable diesel requires energy and chemical inputs. The calculator has a number of required inputs for renewable diesel production. These include data on the co-products. These are discussed below.

3.1 PROCESS

The facility consumes feedstock as documented in the previous section, hydrogen, electricity and natural gas. The processing data is for the period of July 2023 to August 2024.

3.2 MASS INPUTS AND OUTPUTS

The feedstock processed is automatically calculated by the calculator based on receipts and changes in the inventory levels. Process chemicals are a standard value in the CARB calculator.

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 RD sales have been adjusted for the ultra low sulfur diesel that is blended for the Blenders Tax Credit. Each sale / shipment has a documented Independent Inspection Report which quantifies the amount of Renewable Diesel and ULSD. The 'RD Sold' quantities below represent RD100 only, any amounts of ULSD are excluded. The data for the three months corresponding to the new feedstocks is shown in the following table, the same approach is used for the other inpat tables. The CI calculator contains the data from August 2023 to March 2024.

Table 3-1 Renewable Diesel Inventory Data

Month	Opening Inventory	RD Produced	Closing Inventory	RD Sold
	Gallons			
07-2023				
08-2023				
09-2023				
10-2023				
11-2023				
12-2023				
01-2024				
02-2024				
03-2024				
04-2024				
05-2024				
06-2024				
07-2024				
08-2024				
Total				

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

3.3 ENERGY REQUIREMENTS

There are only two external energy inputs into the process. These are invoiced to SBR by the [redacted] receives invoices direct from local utilities for usage for the entire site. SBR has meters installed on the PTU and RDU to measure precise energy and hydrogen use.

The streams are:

1. Natural gas
2. Electricity
3. Hydrogen

3.3.1 Natural Gas

Utility natural gas is used for SBR process heaters. The steam used in the PTU, RDU and to support site operations is generated by [redacted] The steam used by SBR is invoiced based on the net amount used and assumes an 80% boiler efficiency. The net steam and boiler efficiency are used to calculate total MMTBU use. This amount is added to the utility natural gas MMBTU use, as the same emission factor is assumed for both. Additional information and supporting data are contained in the CI Calculator tab 'SBR Steam'. The monthly data is shown in the following table.

Table 3-2 **Natural Gas Usage**

Month	Total NG
	MM BTU (HHV)
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
Total	

3.3.2 Electricity

The refinery purchases electricity from the utility. The consumption is shown in the following table.

Table 3-3 **Electricity Usage**

Month	Total Power
	kWh
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
Total	

3.3.3 Hydrogen

The hydrogen volume is invoiced to SBR at a reference temperature of 70F. The volume is adjusted to 60F in the calculator. [redacted] The hydrogen consumption is shown in the following table.

Table 3-4 **Hydrogen Usage**

Month	Total Hydrogen Consumed
	Scf (60F)
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
Total	

3.4 Co-products

The St. Bernard Renewables plant has four streams that are measured and analyzed for the composition. The streams are the Purge gas stream, the Flash gas stream, the Stabilizer Overheads and the Wild Naphtha stream. The streams are analyzed for the composition and then the energy density of the stream is calculated from the composition and the API tables for the energy content of individual components. The methane and ethane are reported as fuel gas, the propane and butanes are reported as propane and the C5+ is reported as renewable naphtha. All of the data and calculations are found on the Process data tab. Each of these co-product streams are sold to [redacted]

3.4.1 Naphtha

There is some renewable naphtha that is produced in the process.

Table 3-5 Naphtha Production

Month	Naphtha Produced
	Gallons
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
07-2023	

The average energy density of the renewable naphtha over the period was [redacted] BTU/gallon (LHV).

3.4.2 Propane

The quantity of renewable propane produced each month is shown in the following table. This is calculated as the propane and butane in each of the four streams.

Table 3-6 Propane Production

Month	Light Hydrocarbon Produced
	Gallons
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
Total	

The average energy content of this stream is [redacted] BTU/gallon (LHV)

3.4.3 Light Hydrocarbon

The quantity of fuel gas produced each month is shown in the following table. This is calculated as the methane and ethane in each of the four streams. It is calculated each month on a lower heating value basis so the conversion factor to LHV in cell J56 is [redacted]

Table 3-7 Fuel Gas Production

Month	Light Hydrocarbon Produced
	MM BTU (LHV)
07-2023	[redacted]
08-2023	
09-2023	
10-2023	
11-2023	
12-2023	
01-2024	
02-2024	
03-2024	
04-2024	
05-2024	
06-2024	
07-2024	
08-2024	
Total	

3.5 Mass Balance

There is a monthly mass balance check on the Yield Check tab in the calculator. There is a small loss in yield based on the flow that can be measured.

4. RENEWABLE DIESEL TRANSPORT

St. Bernard Renewables distributes their renewable diesel by rail or by ocean tanker from the plant to California. The ocean distance is estimated using [redacted] the calculator uses the further distance [redacted] SBR has chartered [redacted] vessels for transport to CA. [redacted] These are used in alternating rotation and the calculator takes a simple average of [redacted] sizes. The ocean vessel has a capacity used in the calculator is [redacted]. Using this vessel size in the CA GREET 3.0 model produces and emission factor of [redacted] gCO_2e/gallon RD-mile.

The material that is sent by rail is barged [redacted] to a rail loading facility and then shipped [redacted]. Rail miles are based on an average distance to various offload points within CA. The carbon intensity for each route is shown in the following table. The carbon intensity is the highest for the ocean shipping so that is the conservative value used in the application.

Table 4-1 RD Transport Emissions

Transport Option	Distance	Emissions, g/MJ
Ocean	[redacted]	[redacted]
Barge plus rail	[redacted]	[redacted]

5. TANKS TO WHEELS

The tank to wheels 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 CO_2eq/MJ.

6. INDIRECT LAND USE CHANGE

There are indirect land use change emissions for soybean oil and canola oil. The other feedstocks do not have any ILUC associated with them.

7. SUMMARY

The emissions calculated for the individual stages are summed to determine the fuel cycle CI. The results for the St. Bernard Renewables renewable diesel pathways are shown in the following table.

Table 7-1 Lifecycle GHG Emissions – St. Bernard Renewables Renewable Diesel from UCO

Feedstock	SEA UCO	CA UCO	PR/Cay UCO
Stage	gCO_2e/MJ		
Feedstock Production	[redacted]	[redacted]	[redacted]
Fuel Production			
Indirect Land Use	0.00	0.00	0.00
Tailpipe Emissions	0.76	0.76	0.76
RD	31.78	24.19	27.30

Table 7-2 Lifecycle GHG Emissions – St. Bernard Renewables Renewable Diesel from Tallow

Feedstock	ANZ Tallow	Mexico Tallow	UK Tallow
Stage	gCO_2e/MJ		
Feedstock Production	[redacted]	[redacted]	[redacted]
Fuel Production			
Indirect Land Use	0.00	0.00	0.00
Tailpipe Emissions	0.76	0.76	0.76
RD	54.63	29.76	28.50