Appeal of Contra Costa County Planning Commission's Certification for the Final Environmental Impact Report for the Phillips 66 Rodeo Renewed Project.
charlesdavidson@me.com Hercules CA. 11 April 2022

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Re: Appeal of Contra Costa County Planning Commission Certification for the Final Environmental Impact Report for the Phillips 66 Rodeo Renewed Project (File No. LP20-2040 and the Contra Costa County Code, section 26-2.2406)

To the Contra Costa County Board of Supervisors:

The appellant requests that the Board of Supervisors grant this appeal, to reject certification of the Phillips 66 Rodeo Renewed Project FEIR, and instruct the Contra Costa County Department of Conservation and Development and the Planning Commission to develop a revised DEIR, that meets the requirements of CEQA, to be prepared and circulated for public comment.

The County planning commission decision to certify the Final Environmental Impact Report FEIR violated the requirements of the California Environmental Quality Act (CEQA), and was not supported by the evidence presented. This appeal is based on the argument set forth in this appeal letter; the comments submitted concerning the draft Environmental Impact Report (DEIR) and the failure of both the DEIR and the FEIR to comply with the California Low Carbon Fuel Standard.

Inconsistency with California climate pathways.
The Comments presented and this appeal presents detailed analysis of Phillips 66's refinery-level CO2 carbon intensity ("CI"; CO2 greenhouse gas emissions) of "Renewable Diesel" ("RD"), the biodiesel product, for the Rodeo Renewed Project.

Instead of being a low-carbon fuel, the Phillips 66 San Francisco Refinery's anticipated post-Project RD CO2 greenhouse gas emissions (produced during the hydrocracking of animal fats and vegetable oils, on a per barrel basis), would greatly exceed the CO2 emissions of the refinery's current average high-sulfur, heavy petroleum feedstock.

The Phillips 66 Rodeo Renewed Project Draft Environmental Impact Report (DEIR) and Final EIR did not acknowledge that making refinery biodiesel, or so-called renewable diesel, from hydrogenated vegetable oils and animal fats is as energy-consuming or carbon-intensive to refine as the world's dirtiest, most dense and highest sulfur crude oils.

However, if the Phillips 66 were to acknowledge this fact, the refinery would have to contradict their own assertions that their Project's renewable diesel product is not a low-carbon fuel. The actual numbers published in Phillips 66's own DEIR for their Project, which stipulated expected energy usage, hydrogen requirements and CO_2 greenhouse gas emissions, when analyzed, clearly indicate that their renewable diesel (on per barrel basis) is extraordinarily energy-intensive to process and "carbon-intensive".

Instead of being a low-carbon fuel feedstock, animal fat and vegetable oil molecules are triglycerides, like the kind that your doctor measures, and they, counterintuitively, are far more difficult to crack than petroleum oils. The most energy-intensive hydrocracking process for renewable diesel is the hydro-deoxygenation reaction, for which the refinery must greatly expand it hydrogen usage.

In the public or political sphere, if renewable diesel were understood as not being a true low-carbon diesel substitute, then such projects would not be certified to qualify for and be approved for California Low Carbon Fuel Standard (LCFS) credits and Federal subsidies.

Uniquely, the Phillips 66 refinery in Rodeo Contra Costa County, is planning on being the world's largest Renewable Diesel biofuels refinery in the world and is about 12 miles away from the Martinez Marathon refinery, which is planning on being the world's second largest biofuels refinery.

For its part, Marathon proudly claims a reduction in carbon dioxide greenhouse gasses of 60% in their renewable diesel project. However, that 60% CO_2 reduction comes entirely from the 60% smaller daily throughput specified by the project and is entirely NOT from the decreased carbon intensity of the renewable diesel, itself. (1)

Similar for Phillips 66, which will experience a minimum 33% decrease in throughput (from a 4-year pre-COVID average capacity utilization) from 105,000 barrels per day to a maximum of 80,000 bpd. However, at both refineries, the per barrel CO_2 carbon intensities for renewable diesel will actually increase significantly (despite the decrease in throughput), because of the corresponding large increase in hydrogen needed for hydrocracking triglyceride oils. (2a-d)

For example, despite the shimmer of Marathon's 60% decrease in throughput, a simple look at their 42% *increase* in total hydrogen production (made from fossil-fuels), combined with their simultaneous *decreased* throughput, results in a 32% per barrel *increase* in carbon intensity. (1)

Marathon (calculations based on reference #1):

Decrease in total refinery throughput:
(120,000 – 48,000 = 72,000) / 120,000 = 0.6 = - 60% decrease in throughput
Decrease in total refinery-wide CO_2:
1145000 / 2169000 = 0.5278 = - 53% decrease in CO_2

Marathon: Total Refinery CO_2
Pre-Project (Baseline):

Barrels: 120,000 bbl/d * 365 = 43,800,000 bbl/y
CO2 Refinery-wide total: 2169000 mt/y * 1000 = 2169000000 kg/y
Carbon Intensity (GHG-to-BPD ratio): 2169000 * 1000 / 43800000 = 49.52 CO2 kg/bbl

Post Project: Total Refinery CO2
Barrels: 48000 bbl/d * 365 = 17,520,000 bbl/y
CO2 Refinery-wide total: 1,145,000 mt/y * 1000 = 1,145,000,000 kg/y
Carbon Intensity (GHG-to-BPD ratio): 1,145,000,000 / 17,520,000 = 65.35 CO2 kg/bbl

Pre-to-Post project *per barrel* change in Carbon Intensity (Relative % - refinery-wide):
65.35 / 49.52 = 1.32 = + 32% → +32% increase in CI

Pre-to-Post project hydrogen production increase (project total):
962,000 / 678,000 = 1.42 → **+ 42% (increase in total H2-plant CO2 emissions)**

Again, similar to Marathon, post-Project, Phillips will be producing 37% more hydrogen than with petroleum refining and delivering a renewable diesel product with a 36%-to-55% increase in per barrel Carbon Intensity at the refinery level. (2)

Phillips 66 (calculations based on references #2a, 2b, 2c and 2d):

Pre-Project: Total Refinery CO2:
Barrels: 105,000 bbl/d * 365 = 38,300,000 bbl/y
CO2 Refinery-wide total: 2,171,000 mt/y = 2,171,000,000 kg/y
Carbon Intensity (GHG-to-BPD ratio): 2,171,000,000 / 38,300,000 = 56.68 CO2 kg/bbl

Post Project: Total Refinery CO2 (low est.):
Barrels: 80,000 bbl/d * 365 = 29,200,000 bbl/y
CO2 Refinery-wide total: 2,147,000 my/y = 2.147,000,000 kg/y
Carbon Intensity (GHG-to-BPD ratio): 2,147,000,000 / 29,200,000 = 73.53 CO2 kg/bbl

Post Project: Total Refinery CO2 (high est.):
Barrels: 67,000 bbl/d * 365 = 24,455,000 bbl/y
CO2 Refinery-wide total: 2,147,000 my/y = 2.147,000,000 kg/y
Carbon Intensity (GHG-to-BPD ratio): 2,147,000,000 / 24,455,000 = 87.79 CO2 kg/bbl

Pre-to-Post project per barrel change in Carbon Intensity (Relative %):
a. 73.52 / 56.65 = 1.3 = + 30% → 30% increase in CI (low est.)
b. 87.79 / 56.65 = = 1.55 = + 55% → 55% % increase in CI (high est.)

Pre-to-Post project hydrogen Production increase (total from Air Liquide and unit U110):
(120 mscf +22) / (93 mscf + 12 mscf) = 142 mscf / 105 mscf = 1.35 → +35% (increase in H2 production)

The projected Phillips 66 and Marathon Renewable Diesel products, when compared to the processing energy requirements for heavy petroleum refining, would be twice as carbon intensive as the average U.S. refinery's processing of petroleum and as high or higher than the most carbon intensive refineries. (3-7)

> ***[Note see reference #6 for calculations of Phillips 66 and Marathon's estimated increased CO2 emissions for refinery-level (midstream) renewable diesel production via hydrocracking compared to high-sulfur, heavy petroleum hydrocracking at another refinery (based on PRELIM 1.3).*** *And see ref. #7: J. Bergerson, Nature. Avg. US midstream carbon intensity: 40.7 kgCO2e/kg)]*

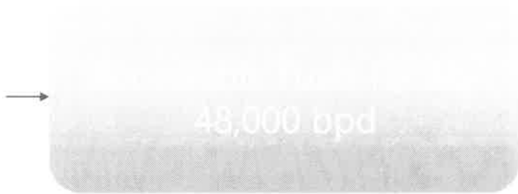
So, what is currently being proposed in Contra Costa County, at the Phillips 66 Refinery, as well as the Marathon Refinery, are very expensive, publicly-funded carbon-intensive renewable diesel projects, which are erroneously being promoted as sources of low-carbon fuel.

As the availability of used cooking oils and waste animal fat markets will be competitive and limited once multiple large refineries enter the renewable diesel business, the default principal feedstock is expected to be soybean oil. At a yield of only 57 gallons of soybeans per acre, however, Phillips 66 alone could annually use up to 33,000 square miles of soybean acreage or nearly the size of the State of Indiana, for its expected 1.22 billion gallons of renewable diesel produced yearly. (8)

Finally, refinery biodiesel is being funded to the tune of up to $3.32 per gallon (according to Stratas Advisers, and depending on the feedstock). That could amount to up to $3 billion *yearly* given to Phillips 66 and $1.8 billion given to Marathon under false pretenses as producers of low carbon biofuels, which flies in the face of a massive increase in *per barrel* carbon intensity and global food security. (9)

REFERENCES:

1) Marathon Renewable Project (Martinez CA; PowerPoint Presentation):



		Refinery	Renewables	Delta Mtonnes/Yr
1	Marathon Martinez	Refinery	Renewables	Delta Mtonnes/Yr
2	Capacity (mbpd)	160	48	
3	MPC GHG H2 Production (MTonnes/Yr)	448	687	239
4	AP GHG H2 Production (MTonnes/Yr)	230	275	45
5	GHG H2 Captured & Sold (MTonnes/Yr)	-56	-56	-
8	GHG All Other Combustion (MTonnes/Yr)	1547	239	-1,308
9	***Total Direct GHG w/ AP (MTonnes/Yr)***	***2169***	***1145***	***-1,024***

~ 60% reduction in GHG as part of project
Will continue to capture & sell 56,000 MT of CO2e

2a) Rodeo Renewed Project (Rodeo CA; 80 K or 67 K barrels per day); Pre-Project (current 105 K bpd):

Rodeo Renewed Project
Draft Environmental Impact Report

Table 4.8-2. Baseline Annual GHG Emissions (2019)[1]

Source Category	Baseline Emissions (metric tons/yr)			
	CO_2	CH_4	N_2O	CO_2e
Rodeo Refinery				
Ocean-going Vessels and Harbor Craft	15,137	0.15	0.93	15,418
Trucks	4,466	0.02	0.70	4,676
Rail	1,373	0.11	0.03	1,386
Facility Operations	1,333,341	91.96	11.74	1,338,911
Electricity	9,160	1.30	0.28	9,270
Rodeo Refinery Total	1,363,477	94	14	1,396,661
Air Liquide H_2 Plant	801,794	--	--	801,794
Santa Maria Site and Pipeline Sites				
Trucks	2,565	0.01	0.40	2,686
Rail	177	0.01	0.00	179
Facility Operations	171,765	17.30	1.43	172,571
Electricity	5,328	0.76	0.16	5,392
Total Statewide	2,345,107	111.62	15.68	2,352,284
Total within BAAQMD	2,165,272	93.54	13.69	2,171,455

1. 2019 is the CEQA baseline for this analysis for all sources except ocean-going vessels and harbor craft. For vessel emissions, an average of 2017 through 2019 was used.
Rodeo Refinery includes emissions from Rodeo Site and Carbon Plant Site
Air Liquide CO_2e emissions assumed to be entirely CO_2 as the breakdown for CH_4 and N_2O is not available.
Facility emissions GHG reporting for 2019 is based on 21 GWP for CH_4 and a 310 GWP for N_2O. It is expected to change to 25 and 298 respectively for reporting years 2021 and forward.

2b) Rodeo Renewed Project (Rodeo CA); Post-Project (completed):

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Table 4.8-5. Total Annual Project Operational GHG Emissions

Source	Emissions (metric tons/yr)			
	CO_2	CH_4	N_2O	CO_2e
Rodeo Renewed Project Emissions				
Ocean Going Vessels and Harbor Craft	26,195	0.28	1.53	26,657
Rail	8,119	0.64	0.20	8,195
Trucks	2,720	0.00	0.43	2,847
Facility Stationary Sources	1,069,772	84.51	10.79	1,075,100
Electricity	1,180	0.41	0.09	2,889
Total Operational	**1,109,661**	**85.84**	**13.04**	**1,115,689**
Air Liquide H_2 Plant	1,031,689	--	--	1,031,689
Total Operational with Air Liquide	**2,141,350**	**85.84**	**13.04**	**2,147,378**
CEQA Impact Evaluation				
Baseline Emissions within BAAQMD	2,165,272	93.54	13.69	2,171,455
Project Minus CEQA Baseline				-24,077
Significance Threshold				10,000
Exceeds Threshold?				No
Statewide Impact Evaluation (Informational only)				
Baseline Emissions Statewide	2,345,107	112	16	2,352,284
Project Minus Statewide Baseline				-204,905

Notes: Rodeo Refinery includes emissions from Rodeo Site and Carbon Plant.
Facility emissions GHG reporting for 2019 is based on 21 GWP for CH_4 and a 310 GWP for N_2O. Based on CARB reporting, it is expected to change to 25 and 298 respectively for reporting years 2021 and forward. Therefore, Project facility emissions are based on 25 GWP for CH_4 and a 298 GWP for N_2O.
The GHG emissions for the Air Liquide hydrogen plant are not reduced to reflect the offset provisions of the Settlement Agreement between ConocoPhillips Company and the Attorney General of California, dated September 10, 2007, and amended May 25, 2010.
Air Liquide CO_2e emissions assumed to be entirely CO_2 as breakdown for CH_4 and N_2O is not available.

2c) Air Liquide Hydrogen Plant H2 production; Table 15; Attachment B, Appendix B:

Stationary Source Table 15
Air Liquide Hydrogen Plant Emissions Summary
Phillips 66 Company - San Francisco Refinery
Rodeo, CA

CAP and GHG Emissions

Scaling Method	Baseline Activity	Project Activity	Units	Pre-Project Emissions (tons/year)						
				NO_x	SO_2	CO	POC	PM_{10}	$PM_{2.5}$	GHGs (MT)
Fuel Combustion	758	987	MMBTU/hr	17	0.010	0.95	1.1	3.6	3.5	--
Hydrogen Production	93.26	120	MMSCF H2/day	--	--	--	--	--	--	801,794
Total				17	0.010	0.95	1.1	3.6	3.5	801,794

Scaling Method	Post-Project Emissions (tons/year)						
	NO_x	SO_2	CO	POC	PM_{10}	$PM_{2.5}$	GHGs (MT)
Fuel Combustion	22	0.013	1.2	1.4	4.7	4.6	--
Hydrogen Production		--	--	--	--	--	1,031,689
Total	22	0.013	1.2	1.4	4.7	4.6	1,031,689

Scaling Method	Change in Emissions (tons/yr)						
	NO_x	SO_2	CO	POC	PM_{10}	$PM_{2.5}$	GHGs (MT)
Fuel Combustion	5.1	0.0031	0.29	0.34	1.1	1.1	--
Hydrogen Production	--	--	--	--	--	--	229,895
Total	5.1	0.0031	0.29	0.34	1.1	1.1	229,895

2d) Unit U110 Phillips 66 Hydrogen Plant H2 Production; table 13; Attachment B, Appendix B:

Stationary Source Table 13
Baseline and Post-Project TAC Emissions from Miscellaneous Project Sources
Phillips 66 Company - San Francisco Refinery
Rodeo, CA

Source ID	Description	Post-Project Status	Emission Type	Baseline Throughput Rate	Baseline Throughput Units	Post-Project Throughput Rate	Post-Project Throughput Units
11	U240 B-201 Heater	Operational	Combustion	56	MMBtu/hr	33	MMBtu/hr
12	U240 B-202 Heater	Operational	Combustion	16	MMBtu/hr	24	MMBtu/hr
13	U240 B-301 Heater	Operational	Combustion	125	MMBtu/hr	93	MMBtu/hr
45	U246 B-801 A/B Heater	Operational	Combustion	62	MMBtu/hr	24	MMBtu/hr
437	Unit 110 Hydrogen Manufacturing Unit	Operational	Hydrogen Plant	12	MMScf/day	22	MMScf/day
433	U110 H-1 Furnace (H2 Plant Reforming)	Operational	Combustion	140	MMBtu/hr	225	MMBtu/hr

Source ID	Baseline Emissions[1] (tons/year)							Post-Project Emissions[2] (tons/year)						
	NOx	SO_2	CO	POC	PM_{10}	$PM_{2.5}$	GHGs (MT)	NOx	SO_2	CO	POC	PM_{10}	$PM_{2.5}$	GHGs (MT)
11	11	13	0.39	1.2	1.6	1.6	29,233	6.8	8.0	0.23	0.71	1.0	1.0	17,492
12	1.8	3.8	0.42	0.34	0.46	0.46	8,271	2.8	5.8	0.64	0.51	0.71	0.71	12,607
13	6.9	30	0.87	2.7	3.7	3.7	66,329	5.2	22	0.65	2.0	2.7	2.7	49,541
45	1.4	0.12	0.82	0.26	0.81	0.81	[illegible]	0.52	0.046	0.32	[illegible]	0.31	0.31	[illegible]
437	--	--	--	--	--	--	100,368	--	--		--	--	--	177,642
433	3.6	4.1	1.3	0.15	4.6	4.6	16,351	5.8	6.7	2.1	0.24	7.4	7.4	26,133

Notes:
1. Baseline emissions were obtained directly from the facility's 2019 BAAQMD Rule 12-15 Emissions Inventory.
2. Post-project emissions were estimated using baseline throughput and emissions and post-project projected rates.

3) Hydrotreating in the production of green diesel. Rasmus Egeberg, Niels Michaelsen, Lars Skyum and Per Zeuthen. *Haldor Topsøe*.

"As the reactions also consume large amounts of hydrogen (for a 100% renewable feed, a hydrogen consumption of 300–400 Nm^3/m^3 is not unusual), higher make-up hydrogen and quench gas flows are needed even when co-processing quite small amounts."

400 (Nm3/m3) = 400 (Nm3/m3) / 6.2 (bbl/MT) * 38 (scf/Nm3/m3) = 2451.61 scf/bbl (2451 / 423) = 5.79 kg/bbl * 9.1 = 52.69 CO2 kg/bbl (hydrogen only)

300 (Nm3/m3) = 400 (Nm3/m3) / 6.2 (bbl/MT) * 38 (scf/Nm3/m3) * 0.75 [(300nM3/M3) / 400 (NM3/M3)]= 1838.70 scf/bbl = (1838.7 / 423) = 4.34 kg/bbl = 39.5 CO2 kg/bbl (hydrogen-production only).

4) PATENTED HYDROCRACKER HYDROGEN USAGE FOR AGAEL BIOFUELS REFINING COMPARED TO SOY OIL. [Pub.No.:US2010/0297749A1 ARAVANIS et al. METHODS AND SYSTEMS FOR BIOFUEL PRODUCTION. Pub.Date: Nov.25,2010] (12)

For comparison of algael oil hydrorefining to soy oil and heavy petroleum hydrorefining, a patented algael biofuels protocol was described for hydrocracking, plus hydroisomerization and feedstock hydrotreating, of 80 barrels per day throughput using 245,000 scfd of hydrogen plant H2. The total hydrogen volume required for the described "Integrated Biofuels Refinery" for algael oil is 3,063 scf per barrel, which would place the algael fuel hydrocracker hydrogen consumption at the upper (heavy petroleum) end of the 1,000-3,000 scf per barrel range. Similar large- and small-size algael biofuels hydrorefinery configurations were described in the patent.

5) Changing Hydrocarbons Midstream. Karras, Greg. Community Energy Resource. Table 2. https://www.energy-resource.com/_files/ugd/bd8505_757a3372387d46358c74d958d158fcb5.pdf

Changing Hydrocarbons Midstream

Table 2. Hydrogen demand for processing different HEFA biomass carbon feeds.

	Standard cubic feet of hydrogen per barrel of biomass feed (SCF/b)			
	Hydrodeoxygenation reactions		Total with isomerization / cracking	
Biomass carbon feed	Saturation [a]	Others [b,c]	Diesel target	Jet fuel target [d]
Plant oils				
Soybean oil	479	1,790	2,270	3,070
Plant oils blend [e]	466	1,790	2,260	3,060
Livestock fats				
Tallow	186	1,720	1,910	2,690
Livestock fats blend [e]	229	1,720	1,950	2,740
Fish oils				
Menhaden	602	1,880	2,480	3,290
Fish oils blend [e]	624	1,840	2,460	3,270
US yield-weighted blends [e]				
Blend without fish oil	438	1,780	2,220	3,020
Blend with 25% fish oil	478	1,790	2,270	3,070

a. Carbon double bond saturation as illustrated in Diagram 1 (a). **b, c.** Depropanation and deoxygenation as illustrated in Diagram 1 (b), (c), and losses to unwanted (diesel target) cracking, off-gassing and solubilization in liquids. d. Jet fuel total also includes H_2 consumed by intentional cracking along with isomerization. **e.** Blends as shown in charts 1-D and 1-F. Data from Tables A1and Appendix at A2.[1] Figures may not add due to rounding.

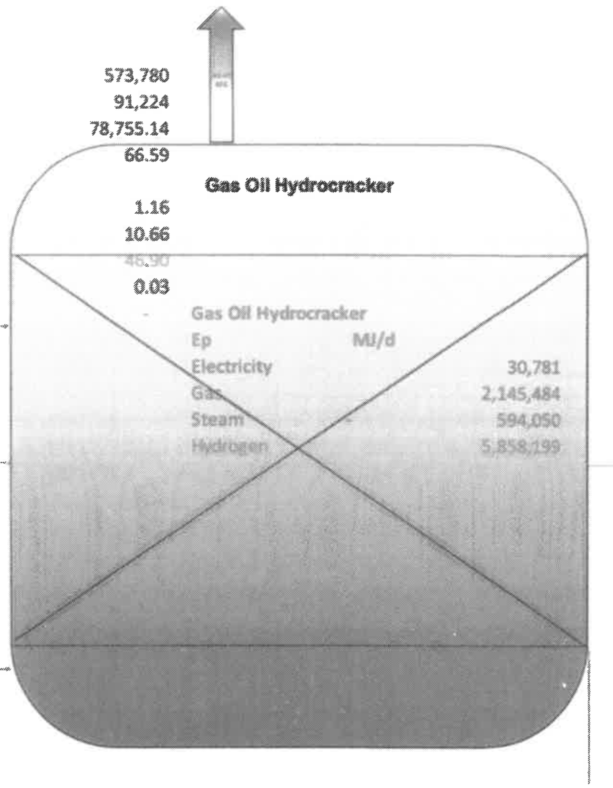
5) ENERGY STAR® Guide: ENERGY STAR is a U.S. Environmental Protection Agency Program for Energy and Plant Managers. (February 2015)
https://www.energystar.gov/sites/default/files/tools/ENERGY_STAR_Guide_Petroleum_Refineries_20150330.pdf

The hydrocracker consumes energy in the form of fuel, steam and electricity (for compressors and pumps)...The reactions are carried out at a temperature of 500-750°F (290-400°C) and increased pressures of 8.3 to 13.8 Bar...The hydrocracker also consumes energy indirectly in the form of hydrogen. The hydrogen consumption is between 150 and 300 scf/barrel of feed (27-54 Nm^3/bbl) for hydrotreating and 1000 and 3000 scf /barrel of feed (180-540 Nm^3/bbl) for the total plant (Gary et al., 2007).

6) Petroleum Refinery Life Cycle Inventory Model (PRELIM) PRELIM v1.3. User guide and technical documentation. Jessica P. Abella et al. [Joule A. Bergerson]
https://www.ucalgary.ca/sites/default/files/teams/477/prelim-v1.3-documentation.pdf
PRELIM 1.3 Hydrocracker with heavy, high-sulfur petroleum feedstock:
14.96 API and 3.35% Sulfur

Gas Oil HC Fuel Gas

Property	Units	
Vol Flow	bpd	573,780
Vol Flow	m^3/d	91,224
Mass Flow	kg/d	78,755.14
Sulphur	wt%	66.59
API gravity	°API	
Density	kg/m^3	1.16
Hydrogen	wt%	10.66
DHc	MJ/kg	46.90
Price	$/bbl	0.03
Allocation	Hydrogen Content Basis	-



Gas Oil Hydrocracker		
Ep	MJ/d	
Electricity		30,781
Gas		2,145,484
Steam	-	594,050
Hydrogen		5,858,199

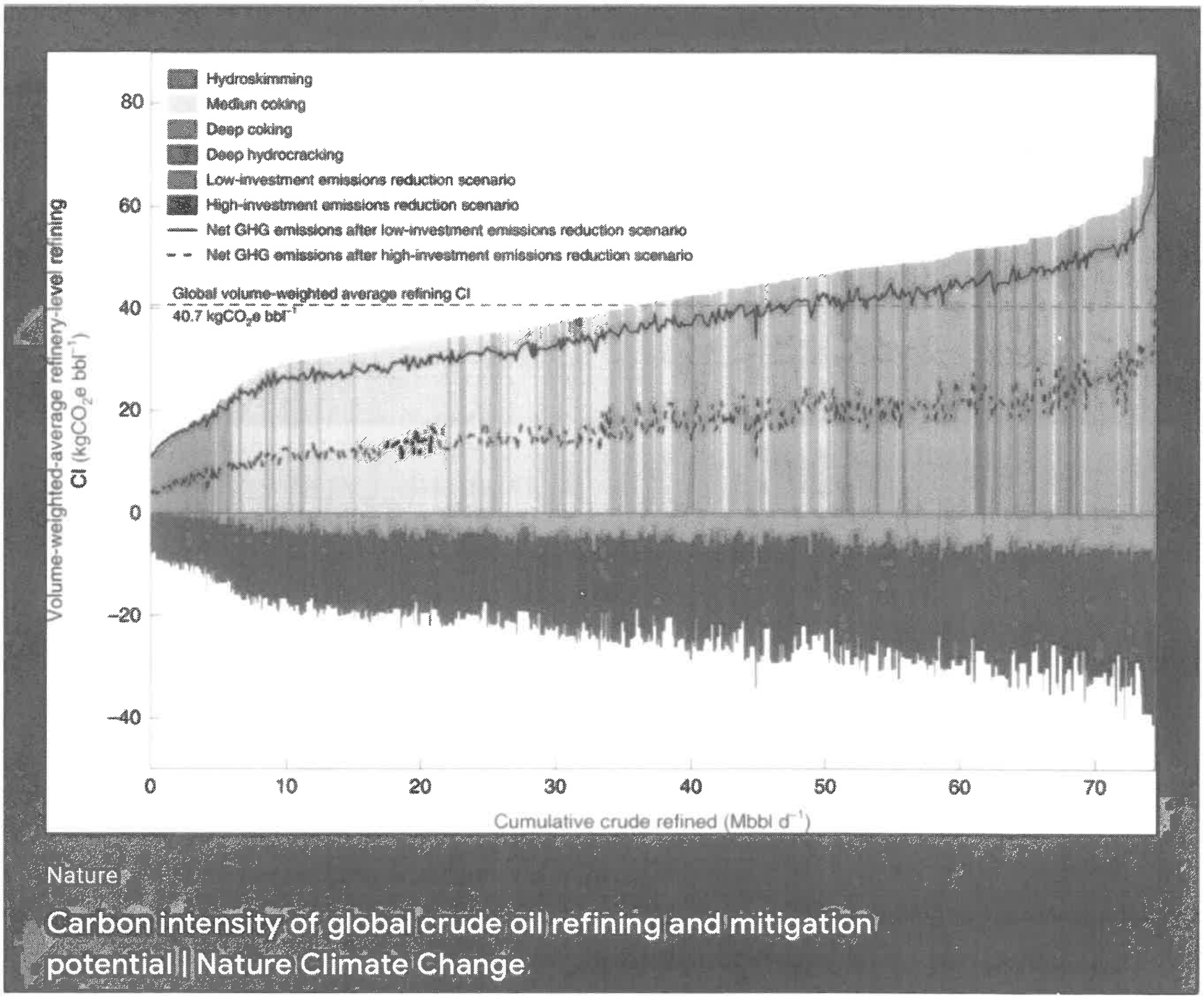
Gas Oil Hydrocracker Feed

Property	***Units***	
Vol Flow	bpd	10,199.87
Vol Flow	m^3/d	1,621.65
Mass Flo	kg/d	1,566,698.34
Sulphur	wt%	3.35
API gravity		14.96
Density	kg/m^3	966.11
Hydrogen	wt%	11.18
MCR	wt%	-
Total hyd	kg/d	43,911.28
DHc	MJ/kg	39.29
Price	$/bbl	85.54
Allocatior	Hydrogen Content Basis	-

PRELIM petroleum-to-Marathon Renewable Project (+32% increase example; predicted Renewable Diesel CI)
Per barrel biofuels CO2 GHGs +32% inc. over petroleum:
Hydrogen per barrel: 44000 (H2/d) / 10200 (bbl/d) * 9.8 * 1.32 = 55.80 kg/bbl
Hydrocracker energy per day: 5858000 + 2145000 + 594000 + 31000 = 8628000
Share of total energy above hydrogen-only energy: 5858000 + 2145000 + 594000 + 31000 / 5858000 = 1.47
Per barrel biofuels predicted carbon intensity: 1.47 * 55.8 = 82.19 CO2 kg/bbl

PRELIM petroleum-to-Rodeo Renewed Project (high and low estimates; predicted Renewable Diesel CI)
44000 / 10200 * 9.8 * 1.47 * 1.30 = 80.78 CO2 kg/bbl (+30% low case est.)
44000 / 10200 * 9.8 * 1.47 * 1.55 = 96.32 CO2 kg/bbl (+55% high case est.)

7) Carbon intensity of global crude oil refining and mitigation potential. Liang Jing et al. *Nature Climate Change* volume 10, pages 526–532 (J. Bergerson; 2020). The global-weighted carbon intensity at crude level is 10.1 – 72.1 kg CO2e/bbl, with a weighted average of 40.7 kgCO2e/kg.



8) Biodiesel. S Sadaka. (FSA1050: DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System). < https://www.uaex.uada.edu/publications/PDF/FSA-1050.pdf>

9) Overcapacity Looms as More and More US Refiners Enter Renewable Diesel Market. Stratas Advisors. (June 11, 2020) <https://stratasadvisors.com/Insights/2020/06112020LCFS-RD-Investment>