Calculation of 2023 Crude Average Carbon Intensity Value

Posting: Each year, pursuant to section 95489(b)(3) of the Low Carbon Fuel Standard (LCFS) Regulation,[1] CARB posts the Annual Crude Average carbon intensity calculation at the CARB-LCFS website for public comment. Written comments shall be accepted for 15 calendar days following the date on which the analysis was posted. Only comments related to potential factual or methodological errors in the posted Annual Crude Average carbon intensity value may be considered. CARB will evaluate the comments received and may request in writing additional information or clarification from the commenters. Commenters shall have 10 days to respond to these requests.

Calculation of 2021, 2022, and 2023 Annual Crude Average Carbon Intensity Values: Table 1 shows California crude volumes and Annual Crude Average carbon intensity values for 2021, 2022, and 2023.[2] Table 2 shows the sources of crude oil supplied to California refineries during 2023 and the carbon intensity values assigned to each source.[3] All crude oil produced in and offshore of California during 2023 was assumed to be refined in California. The volume contributions for California-produced crudes are based on oil production data obtained from the California Department of Conservation.[4] The volume contributions for California federal offshore crudes are based on oil production data obtained from the Bureau of Safety and Environmental Enforcement.[5] The volume contributions of imported crudes are based on oil supply data submitted by refineries as part of annual LCFS reporting. The annual crude average carbon intensity values are a volume-weighted average of the carbon intensities for the crudes supplied in a given year.

Table 1. Crude Volumes and Annual Crude Average Carbon Intensity Values

Year	2021	2022	2023
CI (gCO$_2$e/MJ)	12.80	12.71	12.51
Volume (bbl)	518,262,620	519,754,097	532,457,639

Calculation of California Baseline Crude Average Carbon Intensity:
$CI_{BaselineCrudeAve}$ is the California Baseline Crude Average carbon intensity value, in gCO$_2$e/MJ, attributed to the production and transport of the crude oil supplied as

---

[1] The LCFS regulation is published at California Code of Regulations (CCR), title 17, sections 95480-95503. Subsequent section references are to CCR title 17.
[2] Carbon intensity values and volumes for 2021 and 2022 are from the 2021 Annual Crude CI final (ca.gov) and 2022 Annual Crude CI final (ca.gov), respectively.
[3] Crude carbon intensity values are from Table 9 of the LCFS regulation Low Carbon Fuel Standard. These carbon intensity values are based on oil field data from the year 2015.
[4] California Department of Conservation, WellSTAR Data Dashboard (ca.gov) (accessed July 9, 2024).
[5] Bureau of Safety and Environmental Enforcement website BSEE Pacific Production (accessed July 8, 2024).

petroleum feedstock to California refineries during the baseline calendar year, 2010, and is calculated by the following formula for the 2023 compliance period:

$$CI_{BaselineCrudeAve} = 11.78$$

Calculation of Three-Year California Crude Average Carbon Intensity:
$CI_{2023CrudeAve}$ is the Three-year California Crude Average carbon intensity value, in gCO₂e/MJ, attributed to the production and transport of the crude oil supplied as petroleum feedstock to California refineries during the most recent three calendar years (2021, 2022 and 2023), and is calculated by the following formula:

$$CI_{2023CrudeAve} = \frac{[12.80 \times 518,262,620 + 12.71 \times 519,754,097 + 12.51 \times 532,457,639]}{[518,262,620 + 519,754,097 + 532,457,639]}$$

$$CI_{2023CrudeAve} = 12.67$$

Summary: The Three-year California Crude Average carbon intensity of 12.67 gCO₂e/MJ is greater than the California Baseline Crude Average carbon intensity of 11.78 gCO₂e/MJ plus 0.10 gCO₂e/MJ. Therefore, pursuant to sections 95489(a) and (b) of the LCFS regulation, incremental deficits of $0.89 \times E^{XD} \times C$ for CARBOB or diesel will be added to each affected regulated party's compliance obligation for the annual compliance period of 2025, where E^{XD} is the amount of fuel energy, in MJ, from CARBOB or diesel, as defined in section 95489(a), and $C = 1.0 \times 10^{-6} \frac{MT}{g\ CO2\ e}$.

Table 2. 2023 Refinery Crude Supply

Country/State	Crude Name	CI (g/MJ)	2023 Volume (bbl)
	Annual Crude Average CI	*12.51*	
Angola	Cabinda	11.78	954,911
	Nemba	9.08	948,742
	Pazflor	8.02	2,748,931
Argentina	Medanito	10.78	4,773,969
Brazil	Atapu	11.78	980,422
	Bauna	11.78	2,180,526
	Buzios	11.78	482,022
	Frade	5.63	4,739,320
	Iracema (Cernambi)	5.54	5,835,421
	Lapa	11.78	801,589
	Lula (Tupi)	6.24	16,744,296
	Mero	11.78	2,506,882
	Ostra	5.65	998,497
	Peregrino	4.16	669,586
	Sapinhoa	6.00	12,556,870
Canada	Access Western Blend	15.15	398,158
	Cold Lake	17.87	7,899,383
	Hibernia	11.78	507,234
	Mixed Sweet	8.11	1,022,168
	Namer	11.78	1,033,394
	Syncrude Synthetic (all grades)	31.62	338,453
	Western Canadian Select	19.04	548,821
Colombia	Chaza	11.78	3,982,191
	South Blend	9.25	1,985,914
	Vasconia	9.62	14,698,784
Ecuador	Napo	8.31	11,938,094
	Oriente	10.07	33,727,582
Ghana	Jubiliee	11.78	2,831,868
	Ten Blend	8.08	1,936,401
Guyana	Liza	11.78	7,981,755
	Unity Gold	11.78	24,083,411
Iraq	Basra Medium	11.78	69,616,036
	Basra Heavy	10.69	1,333,216
KAZAKHASTAN	CPC BLEND	11.78	1,967,034

Mexico	Maya	7.85	6,900,212
	Isthmus	11.31	1,918,787
	Mizton	11.78	506,365
	Zapoteco	11.78	3,987,434
Peru	Talara	11.78	5,705
Qatar	Al Shaheen	11.78	995,199
	QATAR LAND	11.78	516,593
Saudi Arabia	Arab Extra Light	9.41	10,503,155
	Arab Light	9.23	38,982,867
	HSFO Crude Blend	11.78	2,412,596
Saudi-Kuwait Neutral Zone	Eocene	7.85	825,925
	Ratawi	9.42	498,094
Trinidad	Molo	11.78	2,012,960
UAE	Das Crude	11.78	1,926,816
	Murban	10.01	4,017,687
US Alaska	ANS	15.91	84,192,117
US North Dakota	Bakken	9.73	683,735
US California*	Aliso Canyon	4.94	52,127
	Ant Hill	20.81	4,437
	Antelope Hills	2.84	45,713
	Antelope Hills, North	24.75	77,630
	Arroyo Grande	31.11	520,155
	Asphalto	8.01	132,325
	Bandini	3.09	5,736
	Bardsdale	3.47	93,656
	Barham Ranch	4.15	64,220
	Beer Nose	3.98	10,042
	Belgian Anticline	5.01	29,599
	Bellevue	5.95	18,898
	Bellevue, West	6.60	10,019
	Belmont, Offshore	5.12	278,562
	Belridge, North	4.11	1,346,348
	Belridge, South	17.09	15,206,560
	Beverly Hills	5.41	327,421
	Big Mountain	4.65	20,021
	Blackwells Corner	3.07	9,091
	Brea-Olinda	3.59	933,363
	Brentwood	11.78	12,640
	Buena Vista	7.44	1,157,414
	Burrel	29.43	15,299
	Cabrillo	4.14	9,676

	Cal Canal Gas	11.78	18,897
	Canal	4.40	9,132
	Canfield Ranch	4.53	53,840
	Cascade	3.00	72,282
	Casmalia	10.26	99,967
	Castaic Hills	2.68	12,484
	Cat Canyon	7.83	1,175,529
	Cheviot Hills	3.49	18,493
	Chico-Martinez	48.13	7,116
	Cienaga Canyon	5.78	9,232
	Coalinga	25.81	4,831,911
	Coles Levee, N	4.09	92,459
	Coles Levee, S	5.87	36,105
	Comanche	5.03	8,894
	Coyote, East	5.96	54,734
	Cuyama, South	14.70	141,049
	Cymric	15.69	12,443,890
	Deer Creek	11.51	28,336
	Del Valle	5.78	24,121
	Devils Den	7.51	7,728
	Dominguez	3.57	8,209
	Edison	14.53	464,794
	El Segundo	4.38	10,872
	Elk Hills	8.02	6,288,605
	Fruitvale	3.75	386,721
	Greeley	7.91	106,432
	Hasley Canyon	2.25	14,234
	Guijarral Hills	11.78	5,103
	Helm	3.99	28,741
	Holser	3.80	10,428
	Honor Rancho	3.43	19,317
	Huntington Beach	6.62	1,294,287
	Hyperion	1.90	10,466
	Howard Townsite	11.78	9,260
	Inglewood	10.06	1,419,854
	Jacalitos	2.72	79,710
	Jasmin	16.59	100,639
	Kern Bluff	12.54	8,092
	Kern Front	35.68	2,423,176
	Kern River	15.09	14,221,135
	Kettleman Middle Dome	3.93	18,849

	Kettleman North Dome	3.42	98,348
	Landslide	12.53	5,513
	Las Cienegas	4.96	77,262
	Long Beach	5.48	1,143,546
	Los Alamos	11.78	7,917
	Los Angeles City	11.78	11,015
	Los Angeles Downtown	5.89	30,628
	Lost Hills	12.99	7,241,726
	Lost Hills, Northwest	5.36	10,032
	Lynch Canyon	23.10	85,805
	Mahala	4.99	5,343
	McDonald Anticline	4.33	33,184
	McKittrick	25.31	3,050,848
	Midway-Sunset	29.33	16,552,447
	Monroe Swell	11.78	7,363
	Montalvo, West	2.65	147,723
	Montebello	17.03	196,806
	Monument Junction	4.95	34,969
	Mount Poso	3.71	1,419,201
	Mountain View	3.97	54,900
	Newport, West	5.21	23,732
	Oak Canyon	4.04	13,727
	Oak Park	3.01	11,566
	Oakridge	3.46	87,920
	Oat Mountain	3.17	44,963
	Ojai	4.94	233,239
	Old Wilmington (ABD)	11.78	14,644
	Olive	1.82	50,172
	Orcutt	11.76	639,566
	Oxnard	5.39	42,998
	Paloma	4.88	12,401
	Placerita	32.78	206,448
	Playa Del Rey	6.87	35,121
	Pleito	2.09	484,415
	Poso Creek	21.96	2,898,551
	Pyramid Hills	3.36	40,401
	Railroad Gap	7.08	60,590
	Raisin City	9.13	60,797
	Ramona	4.47	33,195
	Richfield	4.75	153,716
	Rincon	4.88	163,477

	Rio Bravo	6.98	126,900
	Rio Viejo	2.74	94,618
	Riverdale	3.80	24,057
	Rose	2.91	133,473
	Rosecrans	5.76	80,331
	Rosedale	2.35	30,797
	Rosedale Ranch	8.32	107,298
	Round Mountain	24.04	1,414,489
	Russell Ranch	8.58	36,839
	Salt Lake	3.18	37,376
	Salt Lake, South	6.34	6,899
	San Ardo	26.42	3,990,507
	San Emidio Nose	11.78	15,752
	San Miguelito	5.25	364,470
	San Vicente	3.22	169,399
	Sansinena	3.21	201,087
	Santa Clara Avenue	3.53	25,252
	Santa Fe Springs	12.53	238,179
	Santa Maria Valley	4.80	169,516
	Sargent	4.00	14,105
	Saticoy	3.68	26,670
	Sawtelle	2.56	76,806
	Seal Beach	5.19	337,470
	Semitropic	4.30	22,543
	Sespe	3.98	251,040
	Shafter, North	3.32	318,329
	Shiells Canyon	5.07	38,022
	South Mountain	3.58	288,274
	Stockdale	2.18	87,336
	Tapia	6.92	7,078
	Tejon	13.77	85,174
	Tejon, North	5.63	22,794
	Temescal	3.40	25,389
	Ten Section	7.50	55,602
	Timber Canyon	4.74	29,586
	Torrance	3.99	106,331
	Torrey Canyon	3.52	52,314
	Union Avenue	5.58	42,647
	Vallecitos	4.53	9,472
	Ventura	4.54	2,971,069
	Walnut	11.78	5,993

	Wheeler Ridge	2.80	35,614
	White Wolf	1.92	7,616
	Whittier	3.71	97,005
	Wilmington	8.31	8,278,897
	Yowlumne	13.90	137,617
	Zaca	9.53	120,464
US Federal OCS	Beta	1.59	1,012,574
	Carpinteria	3.28	126,892
	Dos Cuadras	4.57	1,516,753
	Hueneme	4.67	52,377
	Santa Clara	2.46	310,132