

Calculation of 2019 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. No comments were submitted during the public comment period, and CARB is posting the final Annual Crude Average carbon intensity value.

Calculation of 2017, 2018 and 2019 Annual Crude Average Carbon Intensity Values:

Table 1 below shows California crude volumes and Annual Crude Average carbon intensity values for 2017, 2018 and 2019.² Table 2 shows the breakdown of the sources of crude oil supplied to California refineries during 2019 as well as the carbon intensity values assigned to these crude sources.³ All crude oil produced in and offshore of California during 2019 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	2017	2018	2019
CI (gCO ₂ e/MJ)	11.93	12.35	12.52
Volume (bbl)	621,246,732	624,127,435	584,313,143

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 2017 and 2018 are from [Calculation of 2017 Crude Average Carbon Intensity Value](#) and [Calculation of 2018 Crude Average Carbon Intensity Value](#)

³ Crude carbon intensity values are from Table 9 of the LCFS regulation [Low Carbon Fuels Standard](#). These carbon intensity values are based on oil field data from the year 2015.

⁴ California Department of Conservation, [2019 California Oil and Gas Well Monthly Production](#) (accessed May 11, 2020).

⁵ Bureau of Safety and Environmental Enforcement website [BSEE Pacific Production](#) (accessed May 11, 2020).

Calculation of California Baseline Crude Average Carbon Intensity:

$CI_{BaselineCrudeAve}$ is the California Baseline 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 baseline calendar year, 2010, and is calculated by the following formula for the 2019 compliance period:

$$CI_{BaselineCrudeAve} = \frac{[11.98 \times 621,246,732 + 11.78 \times 624,127,435 + 11.78 \times 584,313,143]}{[621,246,732 + 624,127,435 + 584,313,143]}$$

$$CI_{BaselineCrudeAve} = 11.85$$

Calculation of Three-Year California Crude Average Carbon Intensity:

$CI_{2019CrudeAve}$ 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 (2017, 2018 and 2019), and is calculated by the following formula:

$$CI_{2019CrudeAve} = \frac{[11.93 \times 621,246,732 + 12.35 \times 624,127,435 + 12.52 \times 584,313,143]}{[621,246,732 + 624,127,435 + 584,313,143]}$$

$$CI_{2019CrudeAve} = 12.26$$

Summary: The Three-year California Crude Average carbon intensity of 12.26 gCO₂e/MJ is greater than the California Baseline Crude Average carbon intensity of 11.85 gCO₂e/MJ plus 0.10 gCO₂e/MJ. Therefore, pursuant to sections 95489(a) and (b) of the LCFS regulation, incremental deficits of $0.41 \times E^{XD} \times C$ for CARBOB or diesel will be added to each affected regulated party's compliance obligation for the annual compliance period of 2021, where E^{XD} is the amount of fuel energy, in MJ, from CARBOB or diesel, as defined in section 95489(a), and $C = 1.0 \times 10^{-6} \frac{MT}{g CO_2 e}$.

Table 2: 2019 Refinery Crude Supply

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
	Annual Crude Average CI	12.52	584,313,143
Angola	Clov	7.31	3,918
	Dalia	8.90	904,908
	Gimboa	8.86	6,974
	Greater Plutonio	8.72	681
	Nemba	9.08	945,960
	Pazflor	8.02	4,822,092
Argentina	Escalante	10.15	3,669,247
Brazil	Atlanta	11.78	547,445
	Bijupira Salema	7.18	271,972
	Iracema (Cernambi)	5.54	8,180,807
	Lula	6.24	6,193,072
	Peregrino	4.16	616,364
	Sapinhua	6.00	12,240,467
Canada	Access Western Blend	15.15	3,518,916
	Burnaby Blend	11.78	159,680
	Christina Dilbit Blend	12.71	636,375
	Cold Lake	17.87	197,964
	Fort Hills	11.78	2,218,325
	Kearl Lake	12.89	1,937,724
	Mixed Sweet	8.11	149,184
	Peace River Sour	8.11	102,242
	Premium Albian Synthetic	29.49	164,165
	Surmont Heavy Blend	22.48	374,449
	Syncrude Synthetic	31.62	165,594
	Synthetic Sweet Blend	29.36	670,978
	Western Canadian Select	19.04	56,885
Colombia	Castilla	10.55	3,007,404
	Chaza	11.78	1,070,021
	Mares Blend	11.78	607,005
	South Blend	9.25	750,952
	Vasconia	9.62	26,464,151
Ecuador	Napo	8.31	19,911,014
	Oriente	10.07	43,548,568
Equatorial Guinea	Zafiro	20.56	2,074,687
Ghana	Jubilee	11.78	902,458
	Sankofa	11.78	199,492
	Ten Blend	8.08	3,421,587

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
Iraq	Basra Light	13.45	54,931,811
	Basra Heavy	10.69	1,832,776
Kuwait	Kuwait	10.56	8,507,713
Mexico	Maya	7.85	12,256,766
Nigeria	Agbami	12.04	2,568,360
	Antan	21.98	979,892
	Amenam	10.65	1,687,404
	Bonga	5.06	7,602,026
	Erha	10.91	2,424,978
	Forcados	8.97	3,050,214
	Qua Iboe	11.45	907,356
Oman	Oman	13.32	7,275
Peru	Pirana	8.43	175,780
	RPS (Residual Peruano de la Selva)	11.78	90,635
Russia	ESPO	11.55	727,720
	Sokol	6.94	5,224,223
Saudi Arabia	Arab Extra Light	9.41	20,729,323
	Arab Light	9.23	58,226,178
	Arab Medium	8.72	9,228,711
Trinidad	Molo	11.78	2,082,311
UAE	Murban	10.01	1,025,936
Venezuela	Hamaca DCO	10.02	772,920
US Alaska	Alaska North Slope	15.91	75,345,560
US New Mexico	Four Corners	11.11	1,146,069
US North Dakota	North Dakota Sweet	9.73	328,964
US Texas	West Texas Intermediate	11.93	1,420,258
US Utah	Covenant	4.43	82,426
	Utah Sweet	6.92	1,770
US California*	Aliso Canyon	4.94	55,635
	Ant Hill	20.81	17,715
	Antelope Hills	2.84	88,313
	Antelope Hills, North	24.75	232,862
	Arroyo Grande	31.11	457,737
	Asphalto	8.01	162,643
	Bandini	3.09	9,406
	Bardsdale	3.47	140,884
	Barham Ranch	4.15	74,657
	Beer Nose	3.98	9,790
	Belgian Anticline	5.01	39,256

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
	Bellevue	5.95	29,764
	Bellevue, West	6.60	49,495
	Belmont, Offshore	5.12	425,950
	Belridge, North	4.11	1,677,608
	Belridge, South	17.09	19,696,894
	Beverly Hills	5.41	386,445
	Big Mountain	4.65	13,588
	Blackwells Corner	3.07	14,921
	Brea-Olinda	3.59	1,019,426
	Brentwood	11.78	127,191
	Buena Vista	7.44	969,666
	Burrel	29.43	14,068
	Cabrillo	4.14	14,643
	Cal Canal Gas	11.78	19,084
	Canal	4.40	9,645
	Canfield Ranch	4.53	90,992
	Carneros Creek	4.06	12,203
	Cascade	3.00	92,064
	Casmalia	10.26	90,160
	Castaic Hills	2.68	6,435
	Cat Canyon	7.83	1,165,356
	Cheviot Hills	3.49	43,890
	Chico-Martinez	48.13	85,356
	Cienaga Canyon	5.78	12,103
	Coalinga	25.81	5,837,627
	Coles Levee, N	4.09	60,738
	Coles Levee, S	5.87	25,916
	Comanche	5.03	11,490
	Coyote, East	5.96	176,091
	Cuyama, South	14.70	174,690
	Cymric	15.69	12,904,635
	Deer Creek	11.51	34,710
	Del Valle	5.78	24,258
	Devils Den	7.51	8,511
	Dominguez	3.57	5,818
	Edison	14.53	670,084
	El Segundo	4.38	20,532
	Elk Hills	8.02	7,802,455
	Fruitvale	3.75	422,068
	Greeley	7.91	132,616

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
	Hasley Canyon	2.25	24,339
	Helm	3.99	44,991
	Holser	3.80	12,762
	Honor Rancho	3.43	15,599
	Huntington Beach	6.62	1,813,141
	Hyperion	1.90	11,163
	Inglewood	10.06	1,875,880
	Jacalitos	2.72	85,790
	Jasmin	16.59	130,462
	Kern Bluff	12.54	32,808
	Kern Front	35.68	3,282,953
	Kern River	15.09	17,748,828
	Kettleman Middle Dome	3.93	10,731
	Kettleman North Dome	3.42	114,355
	Landslide	12.53	36,536
	Las Cienegas	4.96	137,015
	Livermore	2.66	7,266
	Lompoc	28.45	235,540
	Long Beach	5.48	1,224,456
	Long Beach Airport	4.92	7,222
	Los Angeles Downtown	5.89	34,434
	Lost Hills	12.99	9,057,838
	Lost Hills, Northwest	5.36	14,284
	Lynch Canyon	23.10	194,088
	Mahala	4.99	8,181
	McCool Ranch	9.59	876
	McDonald Anticline	4.33	41,908
	McKittrick	25.31	3,309,294
	Midway-Sunset	29.33	19,644,832
	Montalvo, West	2.65	152,989
	Montebello	17.03	331,036
	Monument Junction	4.95	73,570
	Mount Poso	3.71	1,219,613
	Mountain View	3.97	63,595
	Newhall-Potrero	3.66	36,885
	Newport, West	5.21	69,391
	Oak Canyon	4.04	8,841
	Oak Park	3.01	8,164
	Oakridge	3.46	84,428
	Oat Mountain	3.17	46,649

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
	Ojai	4.94	234,153
	Olive	1.82	45,991
	Orcutt	11.76	869,960
	Oxnard	5.39	195,707
	Paloma	4.88	12,772
	Placerita	32.78	508,182
	Playa Del Rey	6.87	50,623
	Pleito	2.09	465,048
	Poso Creek	21.96	5,301,097
	Pyramid Hills	3.36	44,298
	Railroad Gap	7.08	98,224
	Raisin City	9.13	4,131
	Ramona	4.47	27,363
	Richfield	4.75	165,826
	Rincon	4.88	246,691
	Rio Bravo	6.98	202,083
	Rio Viejo	2.74	133,522
	Riverdale	3.80	21,697
	Rose	2.91	192,140
	Rosecrans	5.76	217,318
	Rosecrans, South	3.54	6,195
	Rosedale	2.35	11,857
	Rosedale Ranch	8.32	98,191
	Round Mountain	24.04	2,583,449
	Russell Ranch	8.58	44,581
	Salt Lake	3.18	35,709
	Salt Lake, South	6.34	4,011
	San Ardo	26.42	8,120,413
	San Emidio Nose	11.78	56,922
	San Miguelito	5.25	351,770
	San Vicente	3.22	162,940
	Sansinena	3.21	224,686
	Santa Clara Avenue	3.53	29,551
	Santa Fe Springs	12.53	586,534
	Santa Maria Valley	4.80	86,525
	Santa Susana	5.29	3,729
	Sargent	4.00	19,040
	Saticoy	3.68	33,297
	Sawtelle	2.56	38,354
	Seal Beach	5.19	381,607

Country/State	Crude Name	CI (g/MJ)	2019 Volume (bbl)
	Semitropic	4.30	21,924
	Sespe	3.98	336,170
	Shafter, North	3.32	407,252
	Shiells Canyon	5.07	45,213
	South Mountain	3.58	383,014
	Stockdale	2.18	91,673
	Tapia	6.92	12,098
	Tapo Canyon, South	3.08	5,192
	Tejon	13.77	208,145
	Tejon Hills	9.39	7,281
	Tejon, North	5.63	26,599
	Temescal	3.40	41,011
	Ten Section	7.50	63,082
	Timber Canyon	4.74	32,557
	Torrance	3.99	344,414
	Torrey Canyon	3.52	61,225
	Union Avenue	5.58	8,203
	Vallecitos	4.53	12,410
	Ventura	4.54	3,860,285
	Wayside Canyon	2.36	2,301
	West Mountain	3.53	7,926
	Wheeler Ridge	2.80	57,135
	White Wolf	1.92	10,065
	Whittier	3.71	99,993
	Wilmington	8.31	10,326,945
	Yowlumne	13.90	324,343
	Zaca	9.53	151,598
US Federal OCS	Beta	1.59	1,655,673
	Carpinteria	3.28	264,883
	Dos Cuadras	4.57	976,747
	Hueneme	4.67	62,327
	Point Pedernales	8.26	1,024,156
	Santa Clara	2.46	465,220

*CI values from Table 9 of the LCFS regulation are based on oil field operational data from the year 2015