

## Calculation of 2020 Crude Average Carbon Intensity Value

**Posting:** Each year, pursuant to section 95489(b)(3) of the Low Carbon Fuel Standard (LCFS) Regulation,<sup>1</sup> 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 2018, 2019 and 2020 Annual Crude Average Carbon Intensity Values:** Table 1 below shows California crude volumes and Annual Crude Average carbon intensity values for 2018, 2019 and 2020.<sup>2</sup> Table 2 shows the breakdown of the sources of crude oil supplied to California refineries during 2020 as well as the carbon intensity values assigned to these crude sources.<sup>3</sup> All crude oil produced in and offshore of California during 2020 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.<sup>4</sup> The volume contributions for California federal offshore crudes are based on oil production data obtained from the Bureau of Safety and Environmental Enforcement.<sup>5</sup> 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	2018	2019	2020
CI (gCO <sub>2e</sub> /MJ)	12.35	12.52	13.41
Volume (bbl)	624,127,435	584,313,143	476,730,992

### Calculation of California Baseline Crude Average Carbon Intensity:

$CI_{BaselineCrudeAve}$  is the California Baseline Crude Average carbon intensity value, in gCO<sub>2e</sub>/MJ, attributed to the production and transport of the crude oil supplied as

<sup>1</sup> The LCFS regulation is published at California Code of Regulations (CCR), title 17, sections 95480-95503. Subsequent section references are to CCR title 17.

<sup>2</sup> Carbon intensity values and volumes for 2018 and 2019 are from [Calculation of 2018 Crude Average Carbon Intensity Value](#) and [Calculation of 2019 Crude Average Carbon Intensity Value](#), respectively.

<sup>3</sup> 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.

<sup>4</sup> California Department of Conservation, [WellSTAR Data Dashboard \(ca.gov\)](#) (accessed May 4, 2021).

<sup>5</sup> Bureau of Safety and Environmental Enforcement website [BSEE Pacific Production](#) (accessed April 28, 2021).

petroleum feedstock to California refineries during the baseline calendar year, 2010, and is calculated by the following formula for the 2020 compliance period:

$$CI_{BaselineCrudeAve} = 11.78$$

Calculation of Three-Year California Crude Average Carbon Intensity:

$CI_{2020CrudeAve}$  is the Three-year California Crude Average carbon intensity value, in gCO<sub>2e</sub>/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 (2018, 2019 and 2020), and is calculated by the following formula:

$$CI_{2020CrudeAve} = \frac{[12.35 \times 624,127,435 + 12.52 \times 584,313,143 + 13.41 \times 476,730,992]}{[624,127,435 + 584,313,143 + 476,730,992]}$$

$$CI_{2020CrudeAve} = 12.71$$

Summary: The Three-year California Crude Average carbon intensity of 12.71 gCO<sub>2e</sub>/MJ is greater than the California Baseline Crude Average carbon intensity of 11.78 gCO<sub>2e</sub>/MJ plus 0.10 gCO<sub>2e</sub>/MJ. Therefore, pursuant to sections 95489(a) and (b) of the LCFS regulation, incremental deficits of  $0.93 \times E^{XD} \times C$  for CARBOB or diesel will be added to each affected regulated party's compliance obligation for the annual compliance period of 2022, 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: 2020 Refinery Crude Supply**

Country/State	Crude Name	CI (g/MJ)	2020 Volume (bbl)
	Annual Crude Average CI	13.41	
Angola	Clov	7.31	8
	Dalia	8.90	904,490
	Nemba	9.08	1,782,271
	Pazflor	8.02	1,017,517
Argentina	Escalante	10.15	486,626
	Medanito	10.78	2,189,008
Brazil	Buzios	11.78	1,840,425
	Frade	5.63	2,248,437
	Iracema (Cernambi)	5.54	1,554,812
	Lapa	11.78	942,216
	Lula	6.24	1,226,126
	Polvo	4.31	919,571
	Sapinhoa	6.00	5,667,264
	Tupi	11.78	1,227,926
Canada	Access Western Blend	15.15	2,614,002
	Christina Dilbit Blend	12.71	790,600
	Fort Hills	11.78	721,753
	Kearl Lake	12.89	490,326
	Premium Albian Synthetic	29.49	165,666
	Suncor Synthetic	27.09	285,272
	Syncrude Synthetic	31.62	914,720
	Synthetic Sweet Blend	29.36	944,083
Colombia	Castilla	10.55	775,183
	South Blend	9.25	309,150
	Vasconia	9.62	17,237,644
Ecuador	Napo	8.31	8,986,455
	Oriente	10.07	46,105,087
Ghana	Ten Blend	8.08	1,166,298
Guyana	Liza	11.78	3,850,077
Iraq	Basra Light	13.45	42,130,348
	Basra Heavy	10.69	3,771,051
Kuwait	Kuwait	10.56	4,299,124
Mexico	Maya	7.85	10,476,031
Nigeria	Agbami	12.04	323,920
	Bonga	5.06	2,139,578
	Erha	10.91	939,663
	Escravos	12.00	932,810
Oman	Oman	13.32	5,930

Country/State	Crude Name	CI (g/MJ)	2020 Volume (bbl)
Peru	Pirana	8.43	82,150
	RPS (Residual Peruano de la Selva)	11.78	302,878
	Talara	11.78	1,247,950
Russia	Sokol	6.94	518,499
Saudi Arabia	Arab Extra Light	9.41	7,408,341
	Arab Light	9.23	41,082,179
	Arab Medium	8.72	3,881,932
Trinidad	Molo	11.78	2,475,813
UAE	Murban	10.01	1,945,909
US Alaska	Alaska North Slope	15.91	91,118,748
US Colorado	Niobrara	6.81	11,764
US New Mexico	Four Corners	11.11	712,266
US North Dakota	Bakken	9.73	561,340
US Texas	West Texas Intermediate	11.93	338,349
US Utah	Covenant	4.43	26,456
	Utah Sweet	6.92	52,749
US California	Aliso Canyon	4.94	85,322
	Ant Hill	20.81	17,491
	Antelope Hills	2.84	78,501
	Antelope Hills, North	24.75	213,301
	Arroyo Grande	31.11	533,196
	Asphalto	8.01	183,016
	Bandini	3.09	8,627
	Bardsdale	3.47	131,475
	Barham Ranch	4.15	69,047
	Beer Nose	3.98	9,769
	Belgian Anticline	5.01	35,827
	Bellevue	5.95	24,418
	Bellevue, West	6.60	22,960
	Belmont, Offshore	5.12	381,903
	Belridge, North	4.11	1,536,729
	Belridge, South	17.09	18,352,116
	Beverly Hills	5.41	321,015
	Big Mountain	4.65	11,919
	Blackwells Corner	3.07	8,922
	Brea-Olinda	3.59	977,943
	Brentwood	11.78	66,925
	Buena Vista	7.44	925,065
	Burrel	29.43	18,339

Country/State	Crude Name	CI (g/MJ)	2020 Volume (bbl)
	Cabrillo	4.14	14,333
	Cal Canal Gas	11.78	18,669
	Canal	4.40	4,927
	Canfield Ranch	4.53	76,147
	Carneros Creek	4.06	3,687
	Cascade	3.00	70,855
	Casmalia	10.26	83,052
	Castaic Hills	2.68	4,179
	Cat Canyon	7.83	1,208,144
	Cheviot Hills	3.49	35,456
	Chico-Martinez	48.13	47,875
	Cienaga Canyon	5.78	9,192
	Coalinga	25.81	5,461,773
	Coles Levee, N	4.09	41,872
	Comanche	5.03	11,026
	Coyote, East	5.96	112,784
	Cuyama, South	14.70	142,483
	Cymric	15.69	11,492,213
	Deer Creek	11.51	28,938
	Del Valle	5.78	26,029
	Devils Den	7.51	8,606
	Dominguez	3.57	2,876
	Edison	14.53	559,202
	El Segundo	4.38	16,602
	Elk Hills	8.02	7,610,254
	Fruitvale	3.75	429,455
	Greeley	7.91	110,861
	Hasley Canyon	2.25	16,213
	Helm	3.99	37,646
	Holser	3.80	13,561
	Honor Rancho	3.43	18,719
	Huntington Beach	6.62	1,731,376
	Hyperion	1.90	3,423
	Inglewood	10.06	1,530,112
	Jacalitos	2.72	84,885
	Jasmin	16.59	114,113
	Kern Bluff	12.54	9,633
	Kern Front	35.68	3,040,588
	Kern River	15.09	16,323,354
	Kettleman Middle Dome	3.93	9,295

Country/State	Crude Name	CI (g/MJ)	2020 Volume (bbl)
	Kettleman North Dome	3.42	111,048
	Landslide	12.53	38,717
	Las Cienegas	4.96	101,270
	Livermore	2.66	3,388
	Lompoc	28.45	216,092
	Long Beach	5.48	1,147,962
	Long Beach Airport	4.92	5,258
	Los Angeles Downtown	5.89	21,714
	Lost Hills	12.99	8,712,052
	Lost Hills, Northwest	5.36	11,767
	Lynch Canyon	23.10	55,856
	Mahala	4.99	6,587
	McDonald Anticline	4.33	38,273
	McKittrick	25.31	3,744,553
	Midway-Sunset	29.33	20,109,910
	Monroe Swell	11.78	10,812
	Montalvo, West	2.65	90,264
	Montebello	17.03	229,654
	Monument Junction	4.95	27,035
	Mount Poso	3.71	1,118,759
	Mountain View	3.97	58,376
	Newhall-Potrero	3.66	33,897
	Newport, West	5.21	52,258
	Oak Canyon	4.04	12,819
	Oak Park	3.01	7,779
	Oakridge	3.46	83,901
	Oat Mountain	3.17	74,796
	Ojai	4.94	260,991
	Olive	1.82	45,177
	Orcutt	11.76	741,278
	Oxnard	5.39	94,214
	Paloma	4.88	10,619
	Placerita	32.78	442,610
	Playa Del Rey	6.87	48,698
	Pleito	2.09	446,362
	Poso Creek	21.96	4,782,402
	Pyramid Hills	3.36	47,336
	Railroad Gap	7.08	74,213
	Raisin City	9.13	5,117
	Ramona	4.47	27,477

Country/State	Crude Name	CI (g/MJ)	2020 Volume (bbl)
	Richfield	4.75	155,929
	Rincon	4.88	443,687
	Rio Bravo	6.98	174,444
	Rio Viejo	2.74	85,585
	Riverdale	3.80	16,553
	Rose	2.91	185,437
	Rosecrans	5.76	140,600
	Rosecrans, South	3.54	12,125
	Rosedale	2.35	11,304
	Rosedale Ranch	8.32	84,292
	Round Mountain	24.04	2,462,728
	Russell Ranch	8.58	42,139
	Salt Lake	3.18	37,149
	Salt Lake, South	6.34	8,034
	San Ardo	26.42	7,313,908
	San Emidio Nose	11.78	89,784
	San Miguelito	5.25	396,098
	San Vicente	3.22	164,308
	Sansinena	3.21	216,082
	Santa Clara Avenue	3.53	28,814
	Santa Fe Springs	12.53	403,929
	Santa Maria Valley	4.80	37,084
	Santa Susana	5.29	3,663
	Sargent	4.00	14,483
	Saticoy	3.68	32,596
	Sawtelle	2.56	143,531
	Seal Beach	5.19	355,079
	Semitropic	4.30	21,212
	Sespe	3.98	319,499
	Shafter, North	3.32	399,868
	Shiells Canyon	5.07	41,755
	South Mountain	3.58	369,105
	Stockdale	2.18	90,958
	Tapia	6.92	8,524
	Tapo Canyon, South	3.08	1,790
	Tejon	13.77	202,313
	Tejon Hills	9.39	5,400
	Tejon, North	5.63	26,106
	Temescal	3.40	38,898
	Ten Section	7.50	50,523

<b>Country/State</b>	<b>Crude Name</b>	<b>CI (g/MJ)</b>	<b>2020 Volume (bbl)</b>
	Timber Canyon	4.74	33,207
	Torrance	3.99	256,963
	Torrey Canyon	3.52	57,593
	Union Avenue	5.58	17,479
	Vallecitos	4.53	8,498
	Ventura	4.54	4,489,592
	Wayside Canyon	2.36	9,658
	West Mountain	3.53	7,970
	Wheeler Ridge	2.80	58,726
	White Wolf	1.92	9,055
	Whittier	3.71	94,579
	Wilmington	8.31	10,190,990
	Yowlumne	13.90	328,626
	Zaca	9.53	85,606
US Federal OCS	Beta	1.59	1,683,922
	Carpinteria	3.28	135,043
	Dos Cuadras	4.57	1,154,100
	Hueneme	4.67	57,418
	Point Pedernales	8.26	1,125,875
	Santa Clara	2.46	412,461