

# Handout 1

## Crude Oil

DRAFT

**Subchapter 10. Climate Change  
Article 4. Regulations to Achieve Greenhouse Gas Emission Reductions**

**Subarticle 7. Low Carbon Fuel Standard**

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**§ 95489. Provisions for Petroleum-Based Fuels.**

**Table 8. Carbon Intensity Lookup Table for Crude Oil Production and Transport**

<b>Country of Origin</b>	<b>Crude Identifier</b>	<b>Carbon Intensity (gCO<sub>2</sub>e/MJ)</b>
Baseline Crude Average*	California Baseline Crude Average applicable to crudes supplied during 2015 and subsequent years	12.71
	California Baseline Crude Average applicable to crudes supplied in 2013 and 2014	11.39
Annual Crude Average	Volume-weighted California average CI for crudes supplied during 2013	11.37
	Volume-weighted California average CI for crudes supplied during 2014	TBD
Algeria	Saharan	11.69
Angola	Cabinda	10.03
	Dalia	9.78
	Gimboa	9.65
	Girassol	10.33
	Greater Plutonio	9.78
	Hungo	9.10
	Kissanje	9.65
	Mondo	9.80
	Nemba	10.19
	Pazflor	8.91
Argentina	Canadon Seco	9.28
	Escalante	9.30
	Hydra	8.08
	Medanito	9.98
Australia	Enfield	5.09
	Pyrenees	5.99
	Stybarrow	6.31
	Van Gogh	6.14
	Vincent	5.05

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Azerbaijan	Azeri	8.25
Brazil	Albacora Leste	6.55
	Bijupira-Salema	8.08
	Frade	6.12
	Jubarte	8.37
	Lula	9.94
	Marlim	7.76
	Marlim Sul	8.49
	Ostra	6.54
	Polvo	6.39
	Roncador	7.44
	Roncador Heavy	7.09
	Sapinhua	8.53
	Cameroon	Lokele
Canada	Access Western Blend	17.21
	Albian Heavy Synthetic	20.52
	Albian Muskeg River Heavy	20.52
	BC Light	8.27
	Bonnie Glen	8.27
	Borealis Heavy Blend	18.32
	Boundary Lake	8.27
	Bow River	9.27
	Cardium	8.27
	Christina Dilbit Blend	14.04
	Christina Synbit	17.90
	Cold Lake	19.64
	Conventional Heavy	9.27
	CNRL Light Sweet Synthetic	21.39
	Federated	8.27
	Fosterton	9.27
	Gibson Light Sweet	8.27
	Halkirk	8.27
	Hardisty Light	8.27
	Hardisty Synthetic	36.96
Husky Synthetic	36.62	
Joarcam	8.27	
Kerrobert Sweet	8.27	
Koch Alberta	8.27	
Light Sour Blend	8.27	
Light Sweet	8.27	
Lloyd Blend	9.27	
Lloyd Kerrobert	9.27	
Lloydminster	9.27	
Long Lake Heavy	32.04	
Long Lake Light Synthetic	37.29	

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	Mackay Heavy Blend	20.76
	Medium Gibson Sour	8.27
	Medium Sour Blend	8.27
	Midale	8.27
	Mixed Sour Blend	8.27
	Mixed Sweet	8.27
	Moose Jaw Tops	8.27
	Peace	8.27
	Peace Pipe Sour	8.27
	Peace River Heavy	22.03
	Peace River Sour	8.27
	Pembina	8.27
	Pembina Light Sour	8.27
	Premium Albian Synthetic	21.39
	Premium Conventional Heavy	9.27
	Premium Synthetic	21.39
	Rainbow	8.27
	Rangeland Sweet	8.27
	Redwater	8.27
	Seal Heavy	9.27
	Shell Synthetic (all grades)	21.39
	Smiley-Coleville	9.27
	Sour High Edmonton	8.27
	Sour Light Edmonton	8.27
	Statoil Cheecham Dilbit	15.32
	Statoil Cheecham Synbit	18.75
	Suncor Synthetic (all grades)	24.16
	Surmont Heavy Blend	18.82
	Synbit Blend	21.65
	Syncrude Synthetic (all grades)	21.39
	Synthetic Sweet Blend	22.78
	Tundra Sweet	8.27
	Wabasca	6.79
	Western Canadian Blend	9.27
	Western Canadian Select	19.31
Chad	Doba	8.08
Colombia	Cano Limon	9.41
	Castilla	9.61
	Cusiana	10.67
	Magdalena	22.27
	Rubiales	9.20
	South Blend	9.22
	Vasconia	9.33
Congo	Azurite	11.49
	Djeno	11.87

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Ecuador	Napo	9.56
	Oriente	10.90
Equatorial Guinea	Ceiba	10.88
	Zafiro	21.56
Iraq	Basra Light	13.08
Kuwait	Kuwait	10.31
Libya	Amna	13.98
Malaysia	Tapis	11.00
Mauritania	Chinquetti	9.28
Mexico	Isthmus	10.16
	Isthmus Topped	13.16
	Maya	7.97
Neutral Zone	Eocene	7.48
	Khafji	9.04
	Ratawi	9.42
Nigeria	Agbami	19.29
	Amenam	17.92
	Antan	33.44
	Bonga	6.44
	Bonny	15.53
	Brass	82.48
	EA	6.24
	Erha	10.50
	Escravos	20.52
	Forcados	22.41
	Okono	27.55
	OKWB	34.80
	Pennington	21.69
	Qua Iboe	15.25
	Yoho	15.25
Oman	Oman	12.72
Peru	Loreto	8.23
	Mayna	9.85
Russia	ESPO	13.70
	M100	19.18
	Sokol	10.51
	Vityaz	11.55
Saudi Arabia	Arab Extra Light	9.35
	Arab Light	9.15
	Arab Medium	8.66
	Arab Heavy	8.77
Thailand	Bualuang	5.12
Trinidad	Calypso	7.37
	Galeota	10.57
UAE	Murban	9.92

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	Upper Zakum	8.97
Venezuela	Bachaquero	26.77
	Boscan	10.76
	Hamaca	23.51
	Hamaca DCO	7.63
	Laguna	26.77
	Mesa 30	11.45
	Petrozuata (all synthetic grades)	23.53
	Zuata (all synthetic grades)	23.51
US Alaska	Alaska North Slope	12.93
US Colorado	Niobrara	8.03
US New Mexico	Four Corners	9.37
	New Mexico Intermediate	9.37
	New Mexico Sour	9.37
	New Mexican Sweet	9.37
US North Dakota	Bakken	10.18
	North Dakota Sweet	10.18
	Williston Basin Sweet	10.18
US Oklahoma	Oklahoma Sour	12.03
	Oklahoma Sweet	12.03
US Texas	Eagle Ford Shale	12.03
	East Texas	12.03
	North Texas Sweet	12.03
	South Texas Sweet	12.03
	West Texas Intermediate	12.03
	West Texas Sour	12.03
US Utah	Covenant	3.78
	Utah Sweet	6.14
US Wyoming	Wyoming Sweet	24.11
US California Fields	Aliso Canyon	4.16
	Ant Hill	22.04
	Antelope Hills	6.56
	Antelope Hills, North	20.91
	Arroyo Grande	32.63
	Asphalto	8.00
	Bandini	6.78
	Bardsdale	3.63
	Barham Ranch	2.64
	Beer Nose	2.50
	Belgian Anticline	3.56
	Bellevue	7.52
	Bellevue, West	4.55
	Belmont, Offshore	4.15
	Belridge, North	4.90
	Belridge, South	16.65

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	Beverly Hills	4.49
	Big Mountain	2.58
	Blackwells Corner	5.03
	Brea-Olinda	3.17
	Buena Vista	7.56
	Burrel	25.23
	Cabrillo	2.49
	Canal	4.17
	Canfield Ranch	3.99
	Carneros Creek	3.40
	Cascade	2.12
	Casmalia	9.35
	Castaic Hills	2.52
	Cat Canyon	4.13
	Cheviot Hills	3.39
	Chico-Martinez	17.24
	Cienaga Canyon	4.08
	Coalinga	32.82
	Coles Levee, N	4.56
	Coles Levee, S	2.70
	Comanche Point	8.32
	Coyote, East	6.15
	Cuyama, South	14.43
	Cymric	21.48
	Deer Creek	9.96
	Del Valle	4.73
	Devils Den	5.88
	Edison	16.67
	El Segundo	3.77
	Elk Hills	6.30
	Elwood, S., Offshore	3.57
	Fruitvale	3.87
	Greeley	9.60
	Hasley Canyon	2.15
	Helm	3.93
	Holser	3.04
	Honor Rancho	4.09
	Huntington Beach	5.11
	Hyperion	2.05
	Inglewood	9.52
	Jacalitos	2.40
	Jasmin	13.98
	Kern Front	29.65
	Kern River	12.99
	Kettleman Middle Dome	3.70

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	Kettleman North Dome	5.14
	Landslide	12.17
	Las Cienegas	4.63
	Livermore	2.56
	Lompoc	19.65
	Long Beach	6.84
	Long Beach Airport	4.02
	Los Angeles Downtown	5.71
	Los Angeles, East	10.02
	Lost Hills	11.18
	Lost Hills, Northwest	3.91
	Lynch Canyon	12.97
	Mahala	2.70
	McCool Ranch	3.32
	McDonald Anticline	4.30
	McKittrick	28.72
	Midway-Sunset	29.27
	Montalvo, West	2.28
	Montebello	14.96
	Monument Junction	3.62
	Mount Poso	11.71
	Mountain View	3.71
	Newhall-Potrero	2.85
	Newport, West	4.38
	Oak Canyon	3.50
	Oak Park	2.48
	Oakridge	2.39
	Oat Mountain	2.59
	Ojai	2.75
	Olive	1.98
	Orcutt	13.35
	Oxnard	9.90
	Paloma	3.51
	Placerita	41.72
	Playa Del Rey	4.58
	Pleito	2.60
	Poso Creek	32.09
	Pyramid Hills	3.34
	Railroad Gap	5.05
	Raisin City	8.72
	Ramona	3.41
	Richfield	4.40
	Rincon	3.93
	Rio Bravo	5.75
	Rio Viejo	2.87



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	Riverdale	3.74
	Rose	2.70
	Rosecrans	5.52
	Rosecrans, South	3.11
	Rosedale	6.49
	Rosedale Ranch	8.00
	Round Mountain	27.77
	Russell Ranch	7.56
	Salt Lake	2.67
	Salt Lake, South	3.84
	San Ardo	31.48
	San Miguelito	5.65
	San Vicente	2.47
	Sansinena	2.56
	Santa Clara Avenue	3.49
	Santa Fe Springs	10.50
	Santa Maria Valley	5.15
	Santa Susana	2.93
	Sargent	3.98
	Saticoy	3.33
	Sawtelle	3.18
	Seal Beach	5.08
	Semitropic	3.48
	Sespe	2.79
	Shafter, North	3.01
	Shiells Canyon	3.38
	South Mountain	3.31
	Stockdale	2.13
	Tapia	7.94
	Tapo Canyon, South	2.92
	Tejon	6.49
	Tejon Hills	6.47
	Tejon, North	3.14
	Temescal	2.75
	Ten Section	6.60
	Timber Canyon	2.99
	Torrance	4.49
	Torrey Canyon	2.73
	Union Avenue	3.57
	Ventura	4.61
	Wayside Canyon	1.67
	West Mountain	2.84
	Wheeler Ridge	4.28
	White Wolf	1.88
	Whittier	2.42

	Wilmington	7.02
	Yowlumne	10.62
	Zaca	8.16
US Federal OCS	Beta	1.71
	Carpinteria	2.85
	Dos Cuadras	4.00
	Hondo	5.54
	Hueneme	3.04
	Pescado	5.72
	Point Arguello	14.23
	Point Pedernales	9.38
	Sacate	3.59
	Santa Clara	2.47
	Sockey	8.35
Default		12.71

\* Based on production and transport of the crude oil supplied to the indicated California refinery(ies) during the baseline calendar year, 2010

- (a) *General.* Deficit calculations to be used for a regulated party's CARBOB or diesel fuel are specified in subdivision (b). Requirements for adding incremental emission increases associated with an increase in the carbon intensity of crude oil to a regulated party's compliance obligation are specified in subdivision (c). The credit calculation for crude oil that is produced using innovative methods, such as carbon capture and sequestration (CCS), is specified in subdivision (d). Special requirements for low-complexity/low-energy-use refineries are specified in subdivision (e). The credit calculation for investments that reduce greenhouse gas emissions at refineries is specified in subdivision (f).
- (b) *Deficit Calculation for CARBOB or Diesel Fuel.* A regulated party for CARBOB or diesel fuel must calculate separately the base deficit and incremental deficit for each fuel or blendstock derived from petroleum feedstock as specified in this provision.

#### Base Deficit Calculation

$$Deficits_{Base}^{XD} (MT) = (CI_{Standard}^{XD} - CI_{BaselineAve}^{XD}) \times E^{XD} \times C$$

#### Incremental Deficit Calculation to Mitigate Increases in the Carbon-Intensity of Crude Oil

If  $CI_{20XXCrudeAve} > CI_{BaselineCrudeAve}$  then:

$$Deficits_{Incremental20XX}^{XD} = (CI_{BaselineCrudeAve} - CI_{20XXCrudeAve}) \times E^{XD} \times C$$

If  $CI_{20XXCrudeAve} \leq CI_{BaselineCrudeAve}$  then:

$$Deficits_{Incremental20XX}^{XD} = 0$$

where,

$Deficits_{Base}^{XD}$  (MT) and  $Deficits_{Incremental20XX}^{XD}$  mean the amount of LCFS deficits incurred (a negative value), in metric tons, by the volume of CARBOB ( $XD = \text{"CARBOB"}$ ) and diesel fuel ( $XD = \text{"diesel"}$ ) that is derived from petroleum feedstock and is either produced in or imported into California during a specific calendar year;

$CI_{Standard}^{XD}$  has the same meaning as specified in section 95486(b)(3)(A);

$CI_{BaselineAve}^{XD}$  is the average carbon-intensity value of CARBOB or diesel, in gCO<sub>2</sub>e/MJ, that is derived from petroleum feedstock and is either produced in or imported into California during the baseline calendar year, 2010. For purposes of this provision,  $CI_{BaselineAve}^{XD}$  for CARBOB ( $XD = \text{"CARBOB"}$ ) and diesel fuel ( $XD = \text{"diesel"}$ ) are the Baseline Average carbon intensity values for CARBOB and diesel (ULSD) set forth in the Carbon Intensity Lookup Table. The Baseline Average carbon intensity values for CARBOB and diesel (ULSD) are calculated using data for crude oil supplied to California refineries during the baseline calendar year, 2010.

$CI_{BaselineCrudeAve}$  is the California Baseline Crude Average carbon intensity value, in gCO<sub>2</sub>e/MJ, attributed to the production and transport of the crude oil supplied as petroleum feedstock to California refineries during the baseline calendar year, 2010. For comparison to  $CI_{2015CrudeAve}$ , the baseline is:

$$CI_{BaselineCrudeAve} = \frac{[11.39 \times V_{2013} + 11.39 \times V_{2014} + 12.71 \times V_{2015}]}{[V_{2013} + V_{2014} + V_{2015}]}$$

For comparison to  $CI_{2016CrudeAve}$ , the baseline is:

$$CI_{BaselineCrudeAve} = \frac{[11.39 \times V_{2014} + 12.71 \times V_{2015} + 12.71 \times V_{2016}]}{[V_{2014} + V_{2015} + V_{2016}]}$$

For comparison to  $CI_{2017CrudeAve}$  and subsequent years, the baseline is

$$CI_{BaselineCrudeAve} = 12.71$$

$CI_{20XXCrudeAve}$  is the Three-year California Crude Average carbon intensity value, in gCO<sub>2</sub>e/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. For example, the Three-year California Crude Average carbon intensity value for 2015 is:

$$CI_{2015CrudeAve} = \frac{[CI_{2013} \times V_{2013} + CI_{2014} \times V_{2014} + CI_{2015} \times V_{2015}]}{[V_{2013} + V_{2014} + V_{2015}]}$$

$V_{20XX}$  is the total volume of crude supplied to California refineries during the specified year 20XX.

$CI_{20XX}$  is the Annual Crude Average carbon intensity value, calculated annually as described in section 95489(c). Annual Crude Average carbon intensity values for 2013 and 2014 are specified in Table 8.

$E^{XD}$  is the amount of fuel energy, in MJ, from CARBOB ( $XD = \text{"CARBOB"}$ ) or diesel ( $XD = \text{"diesel"}$ ), determined from the energy density conversion factors in Table 4, either produced in California or imported into California during a specific calendar year.

$$C = 1.0 \times 10^{-6} \frac{MT}{gCO_2e}$$

- (c) *Addition of Incremental Deficits that Result from Increases in the Carbon-Intensity of Crude Oil to a Regulated Party's Compliance Obligation.*
- (1) Incremental deficits for CARBOB or diesel fuel that result from increases in the carbon intensity of crude oil will be calculated and added to each affected regulated party's compliance obligation for the compliance period in which the  $Deficits_{Incremental20XX}^{XD}$  become effective, which will be the year following the year in which the  $CI_{20XXCrudeAve}$  was established.
  - (2) Incremental deficits for CARBOB or diesel fuel for each regulated party will be based upon the amount of CARBOB and diesel fuel supplied by the regulated party in each compliance period for which the  $Deficits_{Incremental20XX}^{XD}$  are effective.
  - (3) Process for Calculating the Annual Crude Average Carbon Intensity Value.
    - (A) An Annual Crude Average carbon intensity value will be calculated for each calendar year using a volume-weighted average of crude carbon intensity values. The volume for each crude will be the total volume of that crude reported by all regulated parties in the Annual Compliance Reports for the calendar year. Crude carbon intensity values are those listed in Table 8. For crude names not listed, the default carbon intensity value from Table 8 will be used until the

crude name and carbon intensity value is added to Table 8 as described in section 95489(c)(3)(C).

- (B) Within 15 days of receiving the Annual Compliance reports, the Executive Officer shall post the Annual Crude Average carbon intensity calculation at the ARB-LCFS website (<http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>) for public comment. Written comments shall be accepted for 15 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. The Executive Officer shall evaluate the comments received and, if the Executive Officer deems it necessary, may request in writing additional information or clarification from the commenters. Commenters shall be provided 10 days to respond to these requests. The Executive Officer shall post the final Annual Crude Average carbon intensity value at the ARB-LCFS website within 15 days of completion of the comment period, if no comments are received. If comments are received, the Executive Officer shall post the final Annual Crude Average carbon intensity value within 30 days of completion of the comment period or within 25 days of the latest request by the Executive Officer for additional information or clarification from a commenter, whichever is later.
- (C) Revisions to the OPGEE model, addition of crudes to Table 8, and updates to all carbon intensity values listed in Table 8 will be considered on a three-year cycle through proposed amendments of the Low Carbon Fuel Standard regulation.
- (d) *Credits for Producing Crudes using Innovative Methods.* A crude oil producer or refinery receiving the crude may generate credits for crude oil that has been produced using innovative methods and delivered to California refineries for processing.
  - (1) General Requirements.
    - (A) For the purpose of this section, an innovative method means crude production using one or more of the following technologies:
      1. Solar steam generation (generated steam of 65 percent quality or greater). Steam must be used onsite at the crude oil production facilities.
      2. Carbon capture and storage (CCS). Carbon capture must take place onsite at the crude oil production facilities.

3. Solar or wind electricity generation. To qualify for the credit, electricity must be produced and consumed onsite or be provided directly to the crude oil production facilities from a third-party generator and not through a utility owned transmission or distribution network.
  4. Solar heat generation. Heat must be used onsite at the crude oil production facilities.
- (B) The innovative method must become operational no earlier than 2010 for solar steam and CCS projects or 2015 for electricity and heat generation projects and must be approved for use by the Executive Officer before the crude oil producer or purchasing refinery can generate credit under the LCFS regulation. CCS projects must use a Board-approved quantification methodology including monitoring, reporting, verification, and permanence requirements associated with the carbon storage method being proposed for the innovative method.
- (C) The crude oil producer (applicant) must initiate review of the innovative method through a written application to the Executive Officer. If the innovative method involves steam, heat, or electricity produced by a third party and delivered to the crude oil producer, both the crude producer and the third party must apply and will be considered joint applicants for approval of the innovative method. If more than one crude producer receives steam, heat, or electricity from a single third-party facility, each crude producer must submit an independent application with the third party as a joint applicant on each submittal. If the innovative method involves delivery of carbon captured by the crude oil producer to a third party to store the carbon, both the crude producer and the third party must apply and will be considered joint applicants for approval of the innovative method. Third parties that are joint applicants cannot receive credits for the innovative method.
- (D) A crude oil producer must register under section 95483.1 as an opt-in regulated party to receive credits for an approved innovative method. If the crude oil producer using an approved innovative method does not register as an opt-in regulated party, credits generated by the producer's use of the innovative method may be claimed by California refinery(ies) that purchase the crude produced using the innovative method if ARB receives all information it needs to ensure compliance with limitations and reporting requirements applied to the method.

- (E) The innovative method must achieve one of the following threshold criteria:
1. A carbon intensity reduction from the comparison baseline of at least 0.10 gCO<sub>2</sub>e/MJ, or
  2. An emissions reduction of at least 5,000 metric tons CO<sub>2</sub>e per year.

If the innovative method involves more than one crude producer using steam, heat, or electricity produced at a single third-party facility, the threshold criteria listed above may apply to the aggregated project total.

- (F) Credits for producing crude oil with innovative methods must be calculated as specified below:

For crude oil produced using solar steam generation (generated steam of 75 percent quality or greater):

$$Credits_{Innov}(MT) = 29360 \times \frac{V_{steam} \times f_{solar}}{V_{crudeproduced}} \times V_{Innov} \times C$$

For crude oil produced using solar steam generation (generated steam of 65 to 75 percent quality):

$$Credits_{Innov}(MT) = 28011 \times \frac{V_{steam} \times f_{solar}}{V_{crudeproduced}} \times V_{Innov} \times C$$

For crude oil produced using solar or wind based electricity:

$$Credits_{Innov}(MT) = 511 \times \frac{E_{electricity} \times f_{renew}}{V_{crudeproduced}} \times V_{Innov} \times C$$

For crude oil produced using any other innovative method listed in section 95489(d)(1)(A):

$$Credits_{Innov}(MT) = \Delta CI_{Innov} \times E_{Innov} \times V_{Innov} \times C$$

where,

$Credits_{Innov}(MT)$  means the amount of LCFS credits generated (a positive value), in metric tons, by the volume of a crude oil produced using the innovative method and delivered to California refineries for processing;

$V_{steam}$  means the overall volume, in barrels cold water equivalent, of steam injected;

$f_{solar}$  means the fraction of injected steam that is produced using solar;

$V_{crudeproduced}$  means the volume, in barrels, of crude oil produced using the innovative method;

$V_{Innov}$  means the volume, in barrels, of crude oil produced using the innovative method and delivered to California refineries for processing. If the crude produced using the innovative method and delivered to California refineries is part of a blend, then  $V_{Innov}$  is the volume of blend delivered to California refineries multiplied times the volume fraction of the crude within the blend that was produced using the innovative method.

$$C = 1.0 \times 10^{-6} \frac{MT}{gCO_2e}$$

$E_{electricity}$  means the overall electricity consumption to produce the crude, in kW-hr;

$f_{renew}$  means the fraction of consumed electricity that is produced using solar or wind power;

$\Delta CI_{Innov}$  means the reduction in carbon intensity (a positive value), in  $gCO_2e/MJ_{crude}$ , associated with crude oil production with the innovative method as compared to crude oil production by a baseline process without the method (hereafter referred to as the comparison baseline method); and

$E_{Innov}$  means the energy density (lower heating value), in MJ/barrel, for the crude oil produced with the innovative method.

- (2) Application and Data Submittal. Unless otherwise noted, an application for an innovative method shall comply with the requirements below:
  - (A) An applicant that submits any information or documentation in support of a proposed innovative method must include with the application a written statement clearly showing that the applicant understands and agrees to the following:
    1. That all information in the application not identified as confidential business information is subject to public disclosure pursuant to title 17, CCR, sections 91000-91022



and the California Public Records Act (Government Code sec. 6250 et seq.), and that information claimed by the applicant to be confidential might later be disclosed under section 91022 if the state board determines the information is subject to disclosure.

2. That the crude oil producer must register under section 95483.1 as an opt-in regulated party to receive LCFS credit for an innovative method, and that if the crude oil producer does not register as an opt-in regulated party, credits from an approved innovative method may be claimed by California refinery(ies) that purchase crude produced from the innovative method.

(B) An application must contain the following summary material:

1. A complete description of the innovative method and how emissions are reduced;
2. An engineering drawing(s) or process flow diagram(s) that illustrates the innovative method and clearly identifies the system boundaries, relevant process equipment, mass flows, and energy flows necessary to calculate the innovative method credits;
3. A map including global positioning system coordinates for the facilities described in section 95489(d)(2)(B)2.; and
4. A preliminary estimate of the potential innovative method credit, calculated as required in section 95489(d)(1)(F), including descriptions and copies of production and operational data or other technical documentation utilized in support of the calculation.

(C) An application, except for solar-generated steam (65 percent steam quality or greater), wind-based electricity, or solar-based electricity, shall include a detailed description of the innovative method and its comparison baseline method. The description of innovative and comparison baseline methods can be limited to those portions of the crude production process affected by the innovative method. The description of the innovative method and its comparison baseline method must include each of the following, to the extent each is applicable to the innovative method:

1. Schematic flow charts that identify the system boundaries used for the purposes of performing the life cycle analyses

on the proposed innovative method and the comparison baseline method. Each piece of equipment or stream appearing on the process flow diagrams shall be clearly identified and shall include data on its energy and materials balance. The system boundary shall be clearly shown in the schematic.

2. A description of all material and energy inputs entering the system boundaries, including their points of origination, modes of transportation, transportation distances, means of storage, and all processing to which material inputs are subject.
  3. A description of all material and energy products, co-products, byproducts, and waste products leaving the system boundaries, including their respective destinations, transportation modes, and transportation distances.
  4. A description of all facilities within the system boundaries involved in the production of the crude oil and other byproducts, co-products, and waste products.
  5. A description of all combustion and electricity-powered equipment within the system boundaries, including their respective capacities, sizes, or rated power, fuel utilization type, fuel shares, energy efficiency (lower heating value basis), and proposed use.
  6. A description of the thermal and electrical energy production that occurs within the system boundaries, including the respective capacities, sizes, or rated power, fuel utilization type, fuel shares, energy efficiency (lower heating value basis), and proposed use.
  7. A description of all sources of flared, vented, and fugitive emissions within the system boundaries, including the compositions of the flared, vented, and fugitive emission streams leaving the system boundaries.
- (D) An application, except for solar-generated steam (65 percent steam quality or greater), wind-based electricity, or solar-based electricity shall include descriptions of the life cycle assessments (LCAs) performed on the proposed innovative method and its comparison baseline method using the ARB OPGEE model or an alternative model or LCA methodology approved by the Executive Officer. Electronic copies of the models and calculations shall be provided

with the application. The descriptions of the life cycle assessment results must include each of the following:

1. Detailed information on the energy consumed, the greenhouse gas emissions generated for the innovative method and the comparison baseline method;
  2. Documentation of all non-default model input values used in the emissions calculation process. If values for any significant production parameters are unknown, the application shall so state and model default values shall be used for these parameters in the analysis;
  3. Detailed description of all supporting calculations that were performed outside of the model; and
  4. Documentation of all modifications other than those covered by item 2. above, made to the model. This discussion shall include sufficient specific detail to enable the Executive Officer to replicate all such modifications and, in combination with the inputs and supporting calculations identified in items 2. and 3. above, replicate the carbon intensity results reported in the application.
- (E) An application shall include a list of references covering all information sources used in the preparation of the life cycle analysis and calculation of innovative method credit. All reference citations in the application shall include in-text parentheticals stating the author's last name and date of publication. All in-text parenthetical citations shall correspond to complete publication information provided in the list of references, and complete publication information shall, at a minimum, identify the author(s), author's affiliation, title of the referenced document, publisher, publication date, and pages cited. For internet citations, the reference shall include the universal resource locator (URL) address of the citation, as well as the date the website was last visited.
- (F) An application shall include a signed transmittal letter from the applicant attesting to the veracity of the information in the application packet and declaring that the information submitted accurately represents the actual and/or intended long-term, steady-state operation of the innovative method described in the application packet. The transmittal letter shall be the original copy, be on company letterhead, be signed by an officer of the applicant with authority to attest to the veracity of the information in the

application and to sign on behalf of the applicant, and be from the applicant and not from an entity representing the applicant (such as a consultant or legal counsel).

- (G) All documents (including spreadsheets and other items not in a standard document format) that are claimed to contain confidential business information (CBI) must prominently display the phrase "Contains Confidential Business Information" above the main document title and in a running header. Additionally, a separate, redacted version of such documents must also be submitted. The redacted versions must be approved by the applicant for posting to a public LCFS web site. Specific redactions must be replaced with the phrase "Confidential business information has been deleted by the applicant." This phrase must be displayed clearly and prominently wherever CBI has been redacted. If the applicant claims that information it submits is confidential, it must also provide contact information required in section 91011.
  - (H) An application, supporting documents, and all other relevant data or calculation or other documentation, except for the transmittal letter described in section 95489(d)(2)(F), shall be submitted electronically such as via e-mail or an online-based interface unless the Executive Officer has approved or requested in writing another submission format.
- (3) *Application Approval Process.* The application must be approved by the Executive Officer before the crude oil producer or purchasing refinery may generate credit for the innovative method.
- (A) Within 30 calendar days of receipt of an application designated by the applicant as ready for formal evaluation, the Executive Officer shall advise the applicant in writing either that:
    - 1. The application is complete, or
    - 2. The application is incomplete, in which case the Executive Officer will identify which requirements of section 95489(d) have not been met.
      - a. The applicant may submit additional information to correct deficiencies identified by the Executive Officer.
      - b. If the applicant is unable to achieve a complete application within 180 days of the Executive Officer's receipt of the original application, the application will

be denied on that basis, and the applicant will be informed in writing.

- (B) After accepting an application as complete, the Executive Officer will post the application at <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>. Public comments will be accepted for 10 days following the date on which the application was posted. Only comments related to potential factual or methodological errors may be considered. The Executive Officer will forward to the applicant all comments identifying potential factual or methodological errors. Within 30 days, the applicant shall either submit revisions to its application to the Executive Officer, or submit a detailed written response to the Executive Officer explaining why no revisions are necessary.
  - (C) The Executive Officer shall not approve an application if the Executive Officer determines, based upon the information submitted in the application and any other available information, that:
    - 1. The proposed crude production method is not an innovative method, as that term is defined in section 95489(d)(1).
    - 2. Based upon the application information submitted pursuant to this section, the applicant's greenhouse gas emissions calculations cannot be replicated using the ARB OPGEE model or alternative model or LCA methodology approved by the Executive Officer.
  - (D) As part of any action approving an application, the Executive Officer may prescribe conditions of the approval that contain special limitations, recordkeeping and reporting requirements, and operational conditions that the Executive Officer determines should apply to the innovative method. If the Executive Officer determines the application will not be approved, and the applicant will be notified in writing and the basis for the disapproval shall be identified.
- (4) *Recordkeeping.* Each applicant that receives approval for an innovative method must maintain records identifying each facility at which it produces crude oil for sale in California under the approved innovative method. For each such facility, the applicant must maintain records for at least three years showing:
- (A) The quarterly volume of crude oil produced using the approved innovative method and the crude name(s) under which it is marketed. If the crude oil produced with an approved innovative

method is marketed as part of a crude blend, the crude oil producer must also maintain for at least three years quarterly records identifying the name of the blend and the volume fraction that the crude produced with the innovative method contributes to the blend.

- (B) Any additional records that the Executive Officer requires to be kept in pursuant to section 95489(d)(3)(D) , and records that demonstrate compliance with all special limitations and operating conditions specified pursuant to section 95489(d)(3)(D).

These records shall be submitted to the Executive Officer within 20 days of a written request received from the Executive Officer or his/her designee, provided the request is made before the expiration of the period during which the records are required to be retained.

- (5) Credits for producing crude oil using innovative methods. Within 30 days of receiving quarterly reports from California refineries detailing crude names and volumes supplied to the refineries during the previous calendar quarter and any records requested of the applicant under section 95489(d)(4), the Executive Officer will determine the number of credits to be issued to the crude oil producer or purchasing refinery for the innovative method.

(e) *Low-Complexity/Low-Energy-Use Refinery.*

- (1) To be eligible for the credit and deficit calculations in section 95489(e)(3) and the refinery-specific incremental deficit calculation in section 95489(e)(4), a Low-Complexity/Low-Energy-Use Refinery must meet the criteria in section 95481(a)(41) using the following equations:

- (A) Modified Nelson Complexity Score

$$\text{Modified Nelson Complexity Score} = \sum_i^n (\text{index}_i) \left( \frac{\text{Capacity}_i}{\text{Capacity}_{dist}} \right)$$

where:

$\text{index}_i$  is the 2012 Nelson Complexity Index listed in Table 9;

$\text{Capacity}_i$  is the capacity of each unit listed in Table 9;

$\text{Capacity}_{dist}$  is the capacity of the distillation unit;

$i$  is the process unit; and

$n$  is the total number of process units.

**Table 9. Nelson Complexity Indices.**

<b>Process Unit</b>	<b>Index Value</b>
Vacuum Distillation	1.30
Thermal Processes	2.75
Delayed and Fluid Coking	7.50
Catalytic Cracking	6.00
Catalytic Reforming	5.00
Catalytic Hydrocracking	8.00
Catalytic Hydrorefining/Hydrotreating	2.50
Alkylation	10.00
Polymerization	10.00
Aromatics	20.00
Isomerization	3.00
Oxygenates	10.00
Hydrogen	1.00
Sulfur Extraction	240.00

(B) Annual Energy Use

$$\text{Annual Energy Use (in MMBtu)} = \text{fuel use} + \text{electricity} + \text{thermal}$$

where:

*fuel use* is the MMBtu of all fuel combusted during the compliance period;

*electricity* is the imported electricity minus exported electricity per compliance period converted to MMBtu by using 3.142 MMBtu/MWh; and

*thermal* is the imported thermal energy minus exported thermal energy per compliance period in MMBtu.

- (2) In addition to other reporting requirements, a regulated party that is including adjustments or credits for a Low-Complexity/Low-Energy-Use Refinery must also report the following information for that refinery:
- (A) The volume of CARBOB and diesel produced from crude oil;
  - (B) The volume of CARBOB and diesel produced from transmix;
  - (C) The volume of CARBOB and diesel produced from intermediate feedstocks; and
  - (D) The volume of CARBOB and diesel purchased for blending.
- (3) Credits and deficits for a low-complexity/low-energy-use refinery must be calculated in the LCFS Reporting Tool using the following equations:

- (A) *Carbon Intensity Adjustment*. For volumes reported in section 95489(e)(2):

$$CI_{LC-LE}^{XD} = CI_{reported}^{XD} - Adjustment$$

where:

$CI_{Reported}^{XD}$  is the carbon intensity pursuant to section 95486(b)(3);

*Adjustment* is the value listed in Table 10.

**Table 10: Adjustment for CARBOB and diesel**

Volume Reported	Adjustment (gCO <sub>2</sub> e/MJ)
Section 95489(e)(2)(A)	5
Section 95489(e)(2)(B),(C), and (D)	0

- (B) *Credit and Deficit Calculation*. For CARBOB and diesel volumes reported in section 95489(e)(2):

$$Credits_{LC-LE}^{XD} | Deficits_{LC-LE}^{XD} = (CI_{Standard}^{XD} - CI_{LC-LE}^{XD}) \times E^{XD} \times C$$

where:

$CI_{Standard}^{XD}$  is the carbon intensity pursuant to section 95486(b)(3);

$CI_{LC-LE}^{XD}$  is the carbon intensity pursuant to section 95489(e)(3)(A);



$E^{XD}$  is the amount of fuel energy, in MJ, from CARBOB ( $XD = \text{“CARBOB”}$ ) or diesel ( $XD = \text{“diesel”}$ ), determined from the energy density conversion factors in Table 4; and

$C$  is the conversion factor set forth in section 95486(b)(1)

(4) Low-complexity/low-energy-use refineries may elect to use refinery-specific incremental deficit calculation as provided in this section 95489(e)(4) in lieu of the incremental deficit calculation specified in section 95489(b).

(A) Refinery-specific incremental deficit calculation is subject to both of the following restrictions:

1. An authorized officer of the operator of a low-complexity/low-energy-use refinery must notify the Executive Officer of the operator’s intent to use a refinery-specific incremental deficit calculation by delivering a signed written statement to the Executive Officer no later than January 1, 2016. This notification must include a detailed calculation of the Refinery Baseline Crude Average carbon intensity per section 95489(e)(4)(D).
2. The decision to elect to use a refinery-specific incremental deficit calculation is not reversible, and use of the calculation will be mandatory in 2016 and for all future compliance periods.

(B) Only those volumes of CARBOB and diesel fuel produced from crude oil as reported pursuant to section 95489(e)(2)(A) are eligible for refinery-specific incremental deficit calculation. Those volumes of CARBOB and diesel fuel reported pursuant to section 95489(e)(2)(B) through (D) must be assessed the incremental deficit as specified in section 95489(b). The total incremental deficit for the low-complexity/low-energy-use refinery is calculated as follows:

If  $CI_{20XXCrudeAve} > CI_{BaselineCrudeAve}$  and  $CI_{20XXCrudeAve}^{LC-LE} > CI_{BaselineCrudeAve}^{LC-LE}$  then:

$$Deficits_{Incr20XX}^{XD} = [(CI_{BaselineCrudeAve} - CI_{20XXCrudeAve}) \times (1 - VF) + (CI_{BaselineCrudeAve}^{LC-LE} - CI_{20XXCrudeAve}^{LC-LE}) \times VF] \times E^{XD} \times C$$

If  $CI_{20XXCrudeAve} > CI_{BaselineCrudeAve}$  and  $CI_{20XXCrudeAve}^{LC-LE} \leq CI_{BaselineCrudeAve}^{LC-LE}$  then:

$$Deficits_{Incr20XX}^{XD} = (CI_{BaselineCrudeAve} - CI_{20XXCrudeAve}) \times (1 - VF) \times E^{XD} \times C$$

If  $CI_{20XXCrudeAve} \leq CI_{BaselineCrudeAve}$  and  $CI_{20XXCrudeAve}^{LC-LE} > CI_{BaselineCrudeAve}^{LC-LE}$  then:

$$Deficits_{Incr20XX}^{XD} = (CI_{BaselineCrudeAve}^{LC-LE} - CI_{20XXCrudeAve}^{LC-LE}) \times VF \times E^{XD} \times C$$

If  $CI_{20XXCrudeAve} \leq CI_{BaselineCrudeAve}$  and  $CI_{20XXCrudeAve}^{LC-LE} \leq CI_{BaselineCrudeAve}^{LC-LE}$  then

$$Deficits_{Incr20XX}^{XD} = 0$$

where:

$Deficits_{Incr20XX}^{XD}$  means the amount of LCFS incremental deficits incurred (a negative value), in metric tons, by the volume of CARBOB ( $XD = \text{"CARBOB"}$ ) and diesel ( $XD = \text{"diesel"}$ ) that is derived from petroleum feedstock and is either produced at or supplied to the low-complexity/low-energy-use refinery during a specific calendar year;

$CI_{20XXCrudeAve}$  has the same meaning as specified in section 95489(b);

$CI_{BaselineCrudeAve}$  has the same meaning as specified in section 95489(b);

$CI_{20XXCrudeAve}^{LC-LE}$  is the Three-year Refinery Crude Average carbon-intensity value, in gCO<sub>2</sub>e/MJ, attributed to the production and transport of the crude oil supplied as petroleum feedstock to the low-complexity/low-energy-use refinery during specified calendar years.  $CI_{2015CrudeAve}^{LC-LE}$  will be calculated using data for crude oil supplied to the low-complexity/low-energy-use refinery during the calendar year 2015.  $CI_{2016CrudeAve}^{LC-LE}$  will be calculated using data for crude oil supplied to the low-complexity/low-energy-use refinery during the calendar years 2015 and 2016.

$CI_{2017CrudeAve}^{LC-LE}$  will be calculated using data for crude oil supplied to the low-complexity/low-energy-use refinery during the calendar years 2015, 2016, and 2017. All subsequent updates to  $CI_{20XXCrudeAve}^{LC-LE}$  will be calculated using data for crude oil supplied to the low-complexity/low-energy-use refinery during the most recent three calendar years;

$CI_{BaselineCrudeAve}^{LC-LE}$  is the Refinery Baseline Crude Average carbon-intensity value, in gCO<sub>2</sub>e/MJ, attributed to the production and transport of the crude oil supplied as petroleum feedstock to the low-complexity/low-energy-use refinery during the baseline calendar year, 2010. The Baseline Crude Average carbon intensity value is calculated using data for crude oil supplied to the low-complexity/low-energy-use refinery during the baseline calendar year, 2010;

$VF$  means the volume fraction of CARBOB and diesel fuel that is derived from crude oil supplied to the Low-Complexity/Low-Energy-Use refinery;

$E^{XD}$  is the amount of fuel energy, in MJ, from CARBOB ( $XD = \text{"CARBOB"}$ ) or diesel ( $XD = \text{"diesel"}$ ), determined from the energy density conversion factors in Table 4, either produced in California or imported into California during a specific calendar year.

$$C = 1.0 \times 10^{-6} \frac{MT}{gCO_2e}$$

- (C) Process for calculating the Three-year Refinery Crude Average carbon intensity value.
1. The Three-year Refinery Crude Average carbon intensity value will be calculated using a volume-weighted average of crude carbon intensity values. Volumes for crudes will be the total volumes reported by the low-complexity/low-energy-use refinery in the Annual Compliance Report(s) for the calendar year(s). Crude carbon intensity values are those listed in Table 8. For crude names not listed, the default carbon intensity value from Table 8 will be used until the crude name and carbon intensity value is added to Table 8 as described in section 95489(c)(3)(C).
  2. Within 15 days of receiving the Annual Compliance report for the refinery, the Executive Officer shall post the Refinery Crude Average carbon intensity calculation at the ARB-LCFS website (<http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>) for public comment, deleting material that constitutes confidential business information from the posted calculation. Written comments shall be accepted for 15 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. The Executive Officer shall

evaluate the comments received and, if the Executive Officer deems it necessary, may request in writing additional information or clarification from the commenters.

Commenters shall be provided 10 days to respond to these requests. The Executive Officer shall post the final Refinery Crude Average carbon intensity value at the ARB-LCFS website within 15 days of completion of the comment period, if no comments are received. If comments are received, the Executive Officer shall post the final Annual Crude Average carbon intensity value within 30 days of completion of the comment period or within 25 days of the latest request by the Executive Officer for additional information or clarification from a commenter, whichever is later.

- (D) Process for calculating the Refinery Baseline Crude Average carbon intensity value.
1. The Refinery Baseline Crude Average carbon intensity value will be calculated using a volume-weighted average of crude carbon intensity values. Volumes for crudes will be the total volumes supplied to the low-complexity/low-energy-use refinery during the baseline year 2010. Crude carbon intensity values are those listed in Table 11.
  2. The Executive Officer shall evaluate the calculation received from the low complexity-low energy use refinery and, if the Executive Officer deems it necessary, may request in writing additional information or clarification. Upon resolution of all issues associated with the calculation, the Executive Officer shall post the final Refinery Baseline Crude Average carbon intensity value at the ARB-LCFS website, deleting material that constitutes confidential business information from the posted calculation.

**Table 11: Carbon intensity values for crudes supplied during 2010**

Country/State	Crude Name	2010 CI (gCO <sub>2</sub> /MJ)
Angola	Dalia	9.44
	Girassol	9.95
	Greater Plutonio	9.51
Argentina	Canadon Seco	9.14
	Escalante	9.16
	Hydra	8.01
Australia	Pyrenees	5.82

Brazil	Albacora Leste	6.50
	Frade	6.11
	Marlim	7.58
	Marlim Sul	8.40
	Ostra	6.60
	Polvo	6.43
Cameroon	Lokele	24.46
Canada	Albian Heavy Synthetic	20.54
	Cold Lake	19.64
	Federated	7.62
	Koch Alberta	7.62
	Mixed Sweet	7.62
	Suncor Synthetic	23.78
	Syncrude Synthetic	21.44
Colombia	Castilla	9.65
	Vasconia	9.39
Ecuador	Napo	9.82
	Oriente	11.15
Iraq	Basra Light	13.21
Neutral Zone	Eocene	7.27
	Ratawi	9.03
Nigeria	Bonny	17.58
Oman	Oman	12.75
Peru	Loreto	8.62
	Mayna	10.19
Russia	ESPO	13.43
Saudi Arabia	Arab Extra Light	9.16
	Arab Light	9.04
Trinidad	Calypso	7.01
Venezuela	Boscan	10.09
	Petrozuata	23.25
	Zuata	23.22
US Alaska	ANS	11.53
US North Dakota	Bakken	8.71
US California	Aliso Canyon	2.69
	Ant Hill	23.59
	Antelope Hills	3.05
	Antelope Hills, North	13.94
	Arroyo Grande	30.58
	Asphalto	7.00
	Bandini	7.96

	Bardsdale	5.35
	Barham Ranch	2.60
	Belgian Anticline	3.20
	Bellevue	9.02
	Bellevue, West	9.17
	Belmont, Offshore	3.55
	Belridge, North	4.70
	Belridge, South	15.22
	Beverly Hills	4.42
	Big Mountain	2.85
	Brea-Olinda	3.15
	Buena Vista	7.26
	Cabrillo	2.44
	Canal	4.42
	Canfield Ranch	3.82
	Caneros Creek	3.14
	Cascade	2.11
	Casmalia	8.02
	Castaic Hills	3.06
	Cat Canyon	4.00
	Cheviot Hills	3.23
	Cienaga Canyon	4.26
	Coalinga	31.40
	Coalinga, East	17.78
	Coles Levee, N	4.50
	Coles Levee, S	2.67
	Coyote, East	5.88
	Cuyama, South	12.36
	Cymric	22.62
	Deer Creek	10.17
	Del Valle	4.56
	Devils Den	5.58
	Edison	9.28
	El Segundo	3.22
	Elk Hills	5.20
	Elwood, S., Offshore	4.29
	Fruitvale	11.17
	Greeley	8.52
	Hasley Canyon	2.14
	Helm	3.22
	Holser	3.21

	Honor Rancho	3.51
	Huntington Beach	5.37
	Hyperion	1.93
	Inglewood	9.36
	Jacalitos	2.54
	Jasmin	16.07
	Kern Front	28.57
	Kern River	13.46
	Kettleman Middle Dome	3.92
	Kettleman North Dome	4.93
	Landslide	11.14
	Las Cienegas	4.80
	Livermore	2.55
	Lompoc	33.31
	Long Beach	6.48
	Long Beach Airport	4.10
	Los Angeles Downtown	4.39
	Los Angeles, East	8.81
	Lost Hills	11.71
	Lost Hills, Northwest	4.58
	Lynch Canyon	7.83
	McDonald Anticline	5.10
	McKittrick	20.12
	Midway-Sunset	26.07
	Montalvo, West	2.83
	Montebello	11.64
	Monument Junction	3.56
	Mount Poso	15.48
	Mountain View	5.01
	Newhall-Potrero	2.80
	Newport, West	4.00
	Oak Canyon	3.60
	Oak Park	2.27
	Oakridge	2.75
	Oat Mountain	2.11
	Ojai	2.78
	Olive	2.02
	Orcutt	12.43
	Oxnard	16.99
	Paloma	3.55
	Placerita	48.22

	Playa Del Rey	5.60
	Pleito	3.56
	Poso Creek	30.04
	Pyramid Hills	2.96
	Railroad Gap	5.17
	Raisin City	8.05
	Ramona	3.30
	Richfield	3.97
	Rincon	3.60
	Rio Bravo	5.15
	Rio Viejo	2.86
	Riverdale	3.22
	Rose	2.38
	Rosecrans	5.55
	Rosecrans, South	3.32
	Rosedale	7.41
	Rosedale Ranch	8.86
	Round Mountain	31.06
	Russell Ranch	7.92
	Salt Lake	2.56
	Salt Lake, South	3.70
	San Ardo	33.16
	San Miguelito	4.78
	San Vicente	2.40
	Sansinena	2.82
	Santa Clara Avenue	3.48
	Santa Fe Springs	12.46
	Santa Maria Valley	5.06
	Santa Susana	2.86
	Sargent	4.96
	Saticoy	3.45
	Sawtelle	3.00
	Seal Beach	4.98
	Semitropic	3.94
	Sespe	2.84
	Shafter, North	2.77
	Shiells Canyon	3.15
	South Mountain	3.15
	Stockdale	2.12
	Strand	2.56
	Tapia	5.62



	Tapo Canyon, South	2.94
	Tejon	5.86
	Tejon Hills	6.46
	Tejon, North	3.28
	Temescal	3.00
	Ten Section	6.61
	Timber Canyon	3.12
	Torrance	4.83
	Torrey Canyon	2.82
	Union Avenue	2.05
	Ventura	4.69
	Wheeler Ridge	4.30
	White Wolf	1.83
	Whittier	2.46
	Wilmington	6.82
	Yowlumne	11.96
	Zaca	7.99
US Federal OCS	Beta	1.59
	Carpinteria	2.72
	Dos Cuadras	3.92
	Hondo	6.05
	Hueneme	2.80
	Pescado	4.90
	Point Arguello	14.59
	Point Pedernales	6.51
	Sacate	3.47
	Santa Clara	2.36
	Sockeye	6.86

- (f) *Refinery Investment Credit.* A refinery may receive credit for reducing greenhouse gas emissions from its facility.
- (1) *General Requirements.*
- (A) The refinery greenhouse gas emissions reduction project must be implemented during or after the year 2015 and must be approved pursuant to this section before the refinery can receive credit.
- (B) The refinery greenhouse gas emission reduction project must be a capital investment.

- (C) The refinery greenhouse gas emission reduction project must achieve a carbon intensity reduction from the comparison baseline of at least 0.1 gCO<sub>2</sub>e/MJ.
  - (D) The refinery greenhouse gas emission reduction project must not increase criteria air pollutant or toxic air contaminant emissions.
- (2) *Calculation of Credits.*

$$Credits_{RIC}^{XD} = (\Delta CI_{RIC}^{XD} \times E^{XD} \times C) \times M$$

where:

$Credits_{RIC}^{XD}$  is the credit for the refinery greenhouse gas reduction project;

$\Delta CI_{RIC}^{XD}$  is the reduction in carbon intensity (a positive value), in gCO<sub>2</sub>e/MJ, associated with the refinery greenhouse gas reduction project as compared to the refinery without the greenhouse gas reduction project;

$E^{XD}$  is the amount of fuel energy, in MJ, from CARBOB (XD = "CARBOB") or diesel (XD = "diesel"), determined from the energy density conversion factors in Table 4;

$$C = 1.0 \times 10^{-6} \frac{MT}{gCO_2e};$$

$M$  is 0.5 for  $CI_{post}^{XD}$  values above the CARBOB or Diesel refinery carbon intensity industry average as determined from Table 12; and

$M$  is 1.0 for  $CI_{post}^{XD}$  values below the CARBOB or Diesel refinery carbon intensity industry average as determined from Table 12.

**Table 12: CARBOB or Diesel Refinery Carbon Intensity Industry Average**

Fuel Type	Industry Average ( g CO <sub>2</sub> e/MJ)
CARBOB	8.95
Diesel	7.61

$$\Delta CI_{RIC}^{XD} = CI_{pre}^{XD} - CI_{post}^{XD}$$

where:

$\Delta CI_{RIC}^{XD}$  is the reduction in carbon intensity (a positive value), in gCO<sub>2</sub>e/MJ, associated with the refinery greenhouse gas reduction project as compared to the refinery without the greenhouse gas reduction project;

$CI_{pre}^{XD}$  is the carbon intensity of each refinery petroleum product pre-project; and

$CI_{post}^{XD}$  is the carbon intensity of each refinery petroleum product post-project.

$$CI^{XD} = \left[ \frac{AE^{XD}}{EC^{XD}} \right] \left( \frac{10^6 \text{ g}}{\text{metric tons}} \right)$$

where:

$CI^{XD}$  is the carbon intensity of each refinery product.

$$AE^{XD} = \left( \frac{\text{Volume}^{XD}}{\text{Volume}^{Total}} \right) (CO_2e_i)$$

where:

$AE^{XD}$  = amount of emissions apportioned to each product XD output of refinery in metric tons;

$CO_2e_i$  = total emissions for data year i in metric tons;

$\text{Volume}^{XD}$  = volume of individual product output in barrels (bbl);

$\text{Volume}^{Total}$  = total volume of output product in barrels (bbl).

$$EC^{XD} = (\text{Volume}^{XD})(E^{XD}) \left( 42 \left( \frac{\text{gal}}{\text{bbl}} \right) \right)$$

where:

$EC^{XD}$  is the total energy for each product output in MJ;

$\text{Volume}^{XD}$  is the volume of individual product output in barrels (bbl);

$E^{XD}$  is the amount of fuel energy, in MJ/gal, determined from the energy density conversion factors in Table 4.

$$CO_2e_i = (CO_2) + (CH_4)(25) + (N_2O)(298) + electricity + thermal + hydrogen$$

where

$CO_2$  is as reported in CCR, Title 17, section 95100 - 95158;

$CH_4$  is as reported in CCR, Title 17, section 95100 – 95158;

$N_2O$  is as reported in CCR, Title 17, section 95100 – 95158;

*electricity* is imported electricity minus exported electricity per year converted to tons  $CO_2e$  by using 0.431 tons  $CO_2e$ /MWh;

*thermal* is imported thermal energy minus exported thermal energy per year converted to tons  $CO_2e$  by using 0.0663 tons  $CO_2e$ /MMBtu;

*hydrogen* is purchased hydrogen\*10.8 metric tons/ton hydrogen; and

*i* is pre- or post-project.

(3) *Application Contents and Submittal.* Unless otherwise noted, an application for refinery investment credits shall comply with the following requirements:

(A) An application must contain the following summary material:

1. A complete description of the greenhouse gas emissions reduction project and how emissions are reduced;
2. An engineering drawing(s) or process flow diagram(s) that illustrates the investment and clearly identifies the system boundaries, relevant process equipment, mass flows, and energy flows necessary to calculate the refinery investment credits; and
3. A preliminary estimate of the refinery investment credit, calculated as required in section 95489(f)(2), including descriptions and copies of production and operational data or other technical documentation utilized in support of the calculation. The application must contain process-specific data showing that the reductions are part of the transportation fuel pathway.
4. For purchased hydrogen, a refinery may submit supporting documentation that the carbon intensity is different from the carbon intensity listed in section 95489(f)(2).

- (B) An application shall include a list of references covering all information sources used in the calculation of refinery investment credit. The reference list shall, at a minimum, identify the author(s), the author's affiliation, the title of the referenced document, the publisher, and the publication date. All in-text parenthetical citations shall correspond to complete publication information provided in the list of references, and provide pages cited. For internet citations, the reference shall include the universal resource locator (URL) address of the citation, as well as the date the website was last visited.
- (C) An application shall include a signed transmittal letter from the applicant attesting to the veracity of the information in the application packet and declaring that the information submitted accurately represents the actual and/or intended long-term, steady-state operation of the refinery greenhouse gas emissions reduction project described in the application packet. The transmittal letter shall be the original copy, be on company letterhead, be signed by an officer of the applicant with authority to attest to the veracity of the information in the application and to sign on behalf of the applicant.
- (D) All documents (including spreadsheets and other items not in a standard document format) that are claimed to contain confidential business information (CBI) must prominently display the phrase "Contains Confidential Business Information" above the main document title and in a running header. Additionally, a separate, redacted version of such documents must also be submitted. The redacted versions must be approved by the applicant for posting to a public LCFS web site. Specific redactions must be replaced with the phrase "Confidential business information has been deleted by the applicant." This phrase must be displayed clearly wherever CBI has been redacted. If applicant claims that information it submits is confidential, it must also provide contact information required in section 91011.
- (E) An applicant that submits any information or documentation in support of a proposed refinery investment credit must include a written statement clearly showing that the applicant understands and agrees that all information in the application not identified as confidential business information is subject to public disclosure pursuant to CCR, title 17, sections 91000-91022 and the California Public Records Act (Government Code sec. 6250 et seq.), and that information claimed by the applicant to be confidential might later

be disclosed under section 91022 if the state board determines the information is subject to disclosure.

- (F) An application, supporting documents, and all other relevant data or calculation or other documentation, except for the transmittal letter described in section 95489(f)(3)(C), shall be submitted electronically, such as via e-mail or an online-based interface, unless the Executive Officer has approved or requested another format.
- (4) *Application Approval Process.* An application must be approved by the Executive Officer before the greenhouse gas emissions reduction project can generate credits under the LCFS regulation.
- (A) Within 30 calendar days of receipt of an application designated by the applicant as ready for formal evaluation, the Executive Officer shall advise the applicant in writing either that:
    - 1. The application is complete, or
    - 2. The application is incomplete, in which case the Executive Officer will identify which requirements of section 95489(f) have not been met. The applicant may submit additional information to correct deficiencies identified by the Executive Officer. If the applicant is unable to achieve a complete application within 180 days of the Executive Officer's receipt of the original application, the application will be denied on that basis, and the applicant will be informed in writing.
  - (B) After accepting an application as complete, the Executive Officer will post the application at <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>. Public comments will be accepted for 10 calendar days following the date on which the application was posted. Only comments related to potential factual or methodological errors may be considered. The Executive Officer will forward to the applicant all comments identifying potential factual or methodological errors. Within 30 days, the applicant shall either submit revisions to its application to the Executive Officer, or submit a detailed written response to the Executive Officer explaining why no revisions are necessary.
  - (C) If the Executive Officer finds that an application meets the requirements set forth in section 95489(f), the Executive Officer will take final action to approve the greenhouse gas emissions reduction project. The Executive Officer may prescribe conditions of approval that contain special limitations, recordkeeping and

reporting requirements, and operational conditions that the Executive Officer determines should apply to the project. . If the Executive Officer finds that an application does not meet the requirements of section 95489(f), the application will not be approved, and the applicant will be notified in writing, and the basis for the disapproval shall be identified.

- (5) *Credit Review.* Each refinery that has an approved refinery investment credit must solicit Executive Officer review and re-approval of the credit every three years.
  - (A) Refineries shall submit process and emissions data to the Executive Officer for review and approval that confirm the greenhouse gas emission reductions estimated in the original submittal pursuant to the process in section 95489(f)(3) and (4). Failure to submit data for review every three years will result in automatic revocation of the refinery investment credit.
  - (B) When the Executive Officer determines that the carbon intensity reduction from refinery investment credits has decreased by 10 percent or more from the original reduction, the refinery investment credit shall be adjusted to reflect the new credit. If a revised carbon intensity reduction drops below 0.1 gCO<sub>2</sub>e/MJ compared to the refinery's baseline without the refinery greenhouse gas reduction project, the refinery investment credit shall be canceled.
- (6) *Recordkeeping.* For each approved refinery greenhouse gas emissions reduction project, the refinery must compile and retain records pursuant to section 95491(b) showing compliance with all limitation and recordkeeping requirements identified by the Executive Officer pursuant to section 95489(f)(4)(C), above.

NOTE: Authority cited: Sections 38510, 38530, 38560, 38560.5, 38571, 38580, 39600, 39601, 41510, 41511, 43000.5, 43013 and 43018 Health and Safety Code; 42 U.S.C. section 7545, and *Western Oil and Gas Ass'n v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).  
Reference: Sections 38501, 38510, 39515, 39516, 38571, 38580, 39000, 39001, 39002, 39003, 39515, 39516, 41510, 41511 and 43000, Health and Safety Code; Section 25000.5, Public Resources Code; and *Western Oil and Gas Ass'n v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).