CALIFORNIA AIR RESOURCES BOARD

THE CALIFORNIA LOW CARBON FUEL STANDARD REGULATION

DRAFT – FOR DISCUSSION ONLY

October 2008

California Air Resources Board
California Environmental Protection Agency

Purpose of this document

The purpose of this document is to provide a draft regulation of the California Low Carbon Fuel Standard (LCFS), which contains the staff recommendations resulting from stakeholder comments and feedback on the March 2008 LCFS Concept Outline and from ideas and concepts discussed during open-forum working groups and workshops.

This draft regulation is intended to provide stakeholders an opportunity to review and provide input to the staff proposals to date. Stakeholders are encouraged to provide comments on all sections of this draft regulation.

This draft regulation and the previous March Concept Outline can be downloaded at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm#wg under LCFS working group 3, Policy and Regulatory. Additional supporting documents used to develop the concepts herein can be accessed at http://www.arb.ca.gov/fuels/lcfs/lcfs_meetings.htm.

All values shown in this report reflect staff's latest analyses and are for discussion purposes. Final values to be ultimately proposed by staff for the LCFS are still under development. The Executive Officer will conduct a periodic review of the LCFS program in all major areas including, but not limited to: the gasoline and diesel fuel compliance schedules, technology advancements, the supply and rate of commercialization of new fuels and vehicles, lifecycle analysis, land use change, sustainability, uncertainty, policy design, compliance and regulatory process, economic impact, environmental justice, and multimedia evaluation.

Instructions on Submitting Feedback

Please provide your feedback in a separate document containing your name, date, and company letterhead (or equivalent). For each comment, include the section number and name, table number, or figure number to which the comment addresses.

Please submit the document as an *email attachment* with the subject line "Comments for Draft LCFS Regulation" to Christina Zhang-Tillman (czhangti@arb.ca.gov).

All comments received will be posted on the LCFS comments website.

Note: The various italicized "Commentaries" shown in this document provide staff's explanations of the sources of provisions or note potential upcoming modifications under consideration by staff. The Commentaries are not part of the proposed regulatory text.

Nothing in this LCFS regulation amends, repeals, or otherwise changes the California Reformulated Gasoline (CaRFG) regulations (title 13, California Code of Regulations (CCR), §§ 2260 et seq.), the California Diesel Fuel regulations (title 13, CCR, §§ 2281-2285 and title 17, CCR, §93114), or any other applicable State or federal requirements. Any person subject to the LCFS regulation will be responsible for ensuring compliance with all applicable LCFS requirements and all other applicable State and federal requirements.

Draft California Low Carbon Fuel Standard

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Section 95420. Applicability of the Standard

(a) *Applicability of the Low Carbon Fuel Standard.*

(1) The California Low Carbon Fuel Standard (the "LCFS") applies to all California transportation fuels, as defined in section 95427, for which a regulated party is responsible in a calendar year. The types of fuels include the following, when used or intended for use for transportation purposes in California:

(A) California reformulated gasoline ("gasoline" or "CARFG"),
(B) California ultra low sulfur diesel fuel ("diesel fuel" or "ULSD"),
(C) Compressed natural gas ("CNG") or liquefied natural gas ("LNG"),
(D) Liquefied petroleum gas ("LPG" or "propane"),
(E) Electricity,
(F) Compressed or liquefied hydrogen ("hydrogen"),
(G) A fuel blend containing ethanol,
(H) A fuel blend containing biomass-based diesel,
(I) Pure denatured ethanol (E100),
(J) Pure biomass-based diesel (B100), and
(K) Any other liquid or non-liquid fuel.

(b) *Exemption for Alternative Fuels Distributed in Low Volumes for Transportation Uses.*

(1) The LCFS regulation does not apply to an exempted regulated party providing in a calendar year a transportation alternative fuel – other than a biofuel –that is supplied in California by all parties for transportation use at an aggregated volume of less than 420 million MJ (3.6 million gasoline gallon equivalent) per year.

(2) A regulated party wishing to receive an exemption for a calendar year for an alternative fuel must submit to the Executive Officer (i) an LCFS Exemption Application, and (ii) all relevant data and calculations used to demonstrate qualification of exemption. Within 15 business days of receipt of the application, the Executive Officer shall notify the party of any additional information that is needed for the application to be deemed complete. Within 15 business days of receipt of a complete application, the Executive Officer shall grant the application if the applicant has demonstrated that he or she satisfies the criteria in section 95420(b)(1). Upon acting on an application, the Executive Officer shall notify the applicant in writing and the decision shall be posted on ARB's webpage. An exemption may be renewed for subsequent calendar years.

(3) Once an exemption is granted for a calendar year, the exemption shall apply for that year to all parties who would otherwise be regulated parties with respect to the alternative fuel covered by the exemption.

During the exemption period, an exempted party may elect to voluntarily opt-in to the LCFS for that alternative fuel by notifying the Executive Officer in writing. Upon opting into the LCFS, the exempted party shall be subject to all of the requirements for a regulated party with respect to the alternative fuel.

Section 95421. Standards

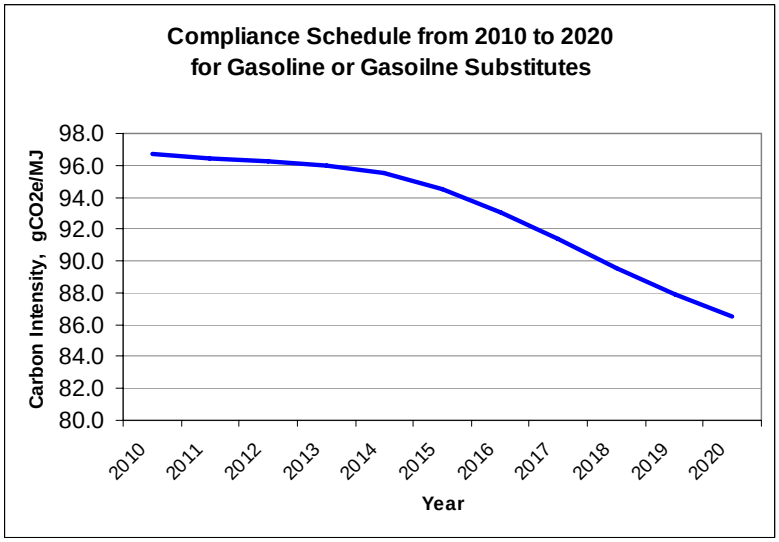
(a) Starting January 1, 2010, the transportation fuel for which a regulated party is responsible in each calendar year must meet the average carbon intensity limits set forth in this section, except as provided in section 95423(b)(4).

(1) *Standards for gasoline and fuels used to substitute for gasoline.* For gasoline and fuels used as gasoline substitutes in section 95422, the standard is set in 2010 using a baseline fuel of CARFG with an ethanol blend of 10 percent by volume ethanol (E10). The baseline carbon intensity standard is 96.7 gCO2e/MJ in 2010. Table 1 shows the carbon intensity standard that must be met in each calendar year following 2010.

Table 1. LCFS compliance schedule for 2010 to 2020 for gasoline or fuels used to substitute for gasoline.

Year	Carbon Intensity (gCO2e/MJ)	% Reduction
2010	96.7	0.0
2011	96.5	-0.3
2012	96.2	-0.5
2013	96.0	-0.8
2014	95.5	-1.3
2015	94.5	-2.3
2016	93.1	-3.8
2017	91.4	-5.5
2018	89.4	-7.5
2019	87.5	-9.5
2020	86.5	-10.5

[Commentary.2010 baseline is CARFG with 10% ethanol (E10) derived from corn, where 80% of the ethanol is produced via dry milling and 20% is produced via wet milling. *To compensate for the corn-ethanol-induced increase in gasoline's carbon intensity, the LCFS requires a 10.5 percent decrease in the carbon intensity of the gasoline fuel group. This reduction is needed to achieve a net 10 percent reduction in the carbon intensity of gasoline from 2010.This schedule is still under review and may be adjusted]*

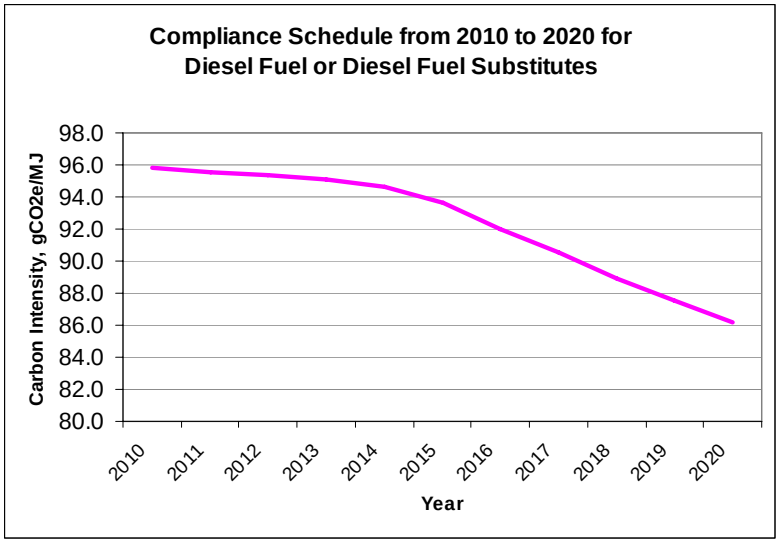


(2) *Standards for diesel fuel and fuels used to substitute for diesel fuel.* For diesel and fuels used as diesel fuel substitutes in section 95422, the standard is set in 2010 using a baseline fuel of ULSD without biomass-based diesel fuel. The baseline carbon intensity standard is 95.8 gCO2e/MJ in 2010. Table 2 shows the carbon intensity standard that must be met in each calendar year following 2010.

Table 2. LCFS compliance schedule for 2010 to 2020 for diesel fuel or fuels used to substitute for diesel fuel.

Year	Carbon Intensity (gCO2e/MJ)	% Reduction
2010	95.8	0.0
2011	95.6	-0.3
2012	95.3	-0.5
2013	95.1	-0.8
2014	94.6	-1.3
2015	93.6	-2.3
2016	92.0	-4.0
2017	90.5	-5.5
2018	88.6	-7.5
2019	86.7	-9.5
2020	86.2	-10.0

[Commentary. This schedule is still under review and may be adjusted]



[Commentary. The standards for gasoline and diesel fuel beyond 2020 will require additional reductions to reflect the need to achieve the AB32 GHG emissions reduction goals in 2050.]

Section 95422. Applicable Standards for Alternative Fuels

(a) For purposes of determining compliance under section 95423 and credits and deficits under section 95424, the following requirements apply to a regulated party that provides an alternative fuel as a transportation fuel:

(1) *Carbon Intensity Requirements for an Alternative Fuel Excluding Biomass-Based Diesel Fuel.*

(A) A regulated party must use the gasoline-standard carbon intensity value in section 95421(a)(1) for its alternative fuel, excluding biomass-based diesel fuel, that is used or is intended to be used in any single-fuel:

1. light-duty vehicle, or
2. medium-duty vehicle.

(B) A regulated party must use the diesel fuel-standard carbon intensity value in section 95421(a)(2) for its alternative fuel, excluding biomass-based diesel, that is used or is intended to be used in any single-fuel application not identified in section 95422(a)(1)(A).

(2) *Carbon Intensity Requirements for Biomass-Based Diesel Fuel.*

(A) A regulated party must use the diesel fuel-standard carbon intensity value in section 95421(a)(2) for its biomass-based diesel fuel is used or is intended to be used in any single-fuel:

1. light-duty vehicle,
2. medium-duty vehicle,
3. heavy-duty vehicle,
4. off-road transportation application,
5. off-road equipment application,
6. locomotive application, or
7. non-stationary source application not otherwise specified in 1-6 above.

(3) *Carbon Intensity Requirements for Transportation Fuels Provided for Use in Multi-Fuel Vehicles (Including Bi-fuel Vehicles)*

(A) For an alternative fuel provided for use in a multi-fueled vehicle (including a bi-fuel vehicle), a regulated party must use:

1. the gasoline-standard carbon intensity value in section 95421(a)(1) if one of the fuels used in the multifuel vehicle is gasoline.

2. the diesel-standard carbon intensity value in section 95421(a)(2) if one of the fuels used in the multifuel vehicle is diesel fuel.

(B) For an alternative fuel provided for use in a multi-fueled vehicle (including a bi-fuel vehicle) that does not use gasoline or diesel fuel, a regulated party must use:

(1) the gasoline-standard carbon intensity value in section 95421(a)(1) if that alternative fuel is used or is intended to be used in:

a. light-duty vehicle, or
b. medium-duty vehicle.

(2) the diesel-standard carbon intensity value in section 95421(a)(2) if that alternative fuel is used or is intended to be used in an application not identified in section 95422(a)(3)(A).

(4) **Table 3. Summary of applicable standards for LCFS-participating transportation fuels.**

For Fuel Used In	Representative Examples	Applicable Standard
Dedicated or multi-fuel vehicles used in LMD applications (except LMD diesel vehicles) OR Dedicated or multi-fuel vehicles operating on gasoline or ethanol blends	Grid-independent hybrids (i.e. Prius); BEV; PHEV; CNG (i.e. Honda CNG); Hydrogen FCV or ICEV; Hydrogen plug-In FCV or ICEV; E85 FFV (LMD or HD); Conventional gasoline vehicle	Gasoline
Dedicated or multi-fuel vehicles used in HD applications OR Dedicated or multi-fuel vehicles operating on diesel fuel, ethanol used for HD applications, or biomass-based-diesel fuel blends OR Off-road transportation, off-road equipment, locomotive	CNG Buses, LNG trucks, Hydrogen FC or ICE Buses Diesel plug-in hybrid (LMD, HD), Conventional diesel vehicle (LMD, HD), Vehicles using B5, B20 Vehicles using E100 (HD) Truck-stop electrification, forklifts, tractors	Diesel fuel

(LMD = light- and medium-duty, HD = heavy-duty, BEV = battery electric vehicle, PHEV=plug-in hybrid electric vehicle, FFV = flex fuel vehicle, FCV = fuel cell vehicle, ICEV = internal combustion engine vehicle)

Section 95423. Compliance

(a) *Regulated Parties.*

(1) *Gasoline and Gasoline Blends.* For gasoline and gasoline blends used as transportation fuel, the regulated parties are the gasoline producers, importers, and certain recipients, as provided for in section 95423(a)(1)(B)-(D).

(A) For purposes of this regulation, "gasoline and gasoline blends" means finished gasoline, California Reformulated Gasoline Blendstocks for Oxygenate Blending (CARBOB), gasoline-alternative fuel blends, and E100 used in light – and medium-duty applications (collectively referred to hereinafter as "gasoline").

For purposes of this regulation, the producer or importer of pure ethanol (E100) that provides E100 as a finished transportation fuel is treated as a gasoline producer or importer. An E100 producer or importer is subject to the same reporting requirements that apply to a gasoline producer or importer as specified in section 95423(c). The E100 producer or importer must determine the carbon intensity of the E100 by any of the methods specified in section 95425 for ethanol blendstocks, not for gasoline.

(B) *Transfer of Gasoline and Compliance Obligation.*

This provision applies only before the gasoline is transferred from its "final distribution facility," which has the same meaning as specified in 13 CCR § 2260(a)(11). Except as provided for in section 95423(a)(1)(C) below, on each occasion when any person transfers custody or title of gasoline (i.e., the transferor), the recipient of the gasoline (i.e., the transferee) assumes the LCFS compliance obligation. At this point, the recipient becomes the regulated party under the LCFS regulation and is responsible for the acquired gasoline. The transferor shall provide the recipient and the Executive Officer a document that prominently states:

1. the volume and average carbon intensity of the transferred gasoline; and

2. the recipient is now the regulated party that is responsible for the acquired gasoline and for meeting the requirements of the LCFS regulation for that gasoline.

(C) *Transfer of Gasoline and Retaining Compliance Obligation.*

Section 95423(a)(1)(B) notwithstanding, the transferor may choose to remain the regulated party and retain the LCFS compliance

obligation for the transferred gasoline substitute by written contract with the recipient. The transferor shall provide a copy of such a contract to the Executive Officer upon request. The transferor shall provide the transfer document, meeting the requirements specified in section 95423(a)(1)(B)1, to both the Executive Officer and the recipient.

(D) *No Post-Transfer Modifications To Transferred Gasoline By A Non-Regulated Party.*

No person to whom the gasoline has been transferred may blend into, add anything to, or otherwise modify the gasoline unless that person:

1. has become the regulated party for that gasoline pursuant to section 95423(a)(1)(B). In this case, the regulated party (transferee or recipient) shall be responsible for complying with the LCFS regulation (including responsibility for credits and deficits) for the portion of the finished fuel that the regulated party blended, added, or otherwise modified; or

2. is under a contractual obligation with the regulated party to make the modification as specified in the contract. In this case, the regulated party (transferor) remains responsible for complying with the LCFS regulation for the entire finished fuel, including any portion that is blended, added, or otherwise modified by the recipient.

(2) *Diesel Fuel and Diesel Fuel Blends.* For diesel fuel and diesel fuel blends used as transportation fuel, the regulated parties are the diesel fuel producers, importers, and certain recipients, as provided for in section 95423(a)(2)(B)-(D).

(A) For purposes of this regulation, “diesel fuel and diesel fuel blends” means finished diesel fuel, diesel-alternative fuel blends, E100 used in heavy-duty applications, and B100 (collectively referred to hereinafter as “diesel fuel”).

For purposes of this regulation, the producer or importer of pure biodiesel (B100) that provides B100 as a finished transportation fuel is treated as the diesel fuel producer or importer. B100 is subject to the same reporting requirements that apply to a diesel fuel producer or importer as specified in section 95423(c). The B100 producer or importer must determine the carbon intensity of the B100 by any of the methods specified in section 95425 for biodiesel blendstocks, not for gasoline.

(B) *Transfer of Diesel Fuel and Compliance Obligation.*

This provision applies only before the diesel fuel/diesel fuel substitute is transferred from its "final distribution facility," which has the same meaning as in 13 CCR § 2281 et seq. Except as provided for in section 95423(a)(2)(C) below, on each occasion when any person transfers custody or title of diesel fuel (i.e., the transferor), the recipient of the diesel fuel (i.e., the transferee) assumes the LCFS compliance obligation. At this point, the recipient becomes the regulated party under the LCFS regulation and is responsible for the acquired diesel fuel. The transferor shall provide the recipient and the Executive Officer a document that prominently states:

1. the volume and average carbon intensity of the transferred diesel fuel; and

2. the recipient is now the regulated party that is responsible for the acquired diesel fuel and for meeting the requirements of the LCFS regulation for that diesel fuel.

(C) *Transfer of Diesel Fuel and Retaining Compliance Obligation.*

Section 95423(a)(2)(B) notwithstanding, the transferor may choose to remain the regulated party and retain the LCFS compliance obligation for the transferred diesel fuel by written contract with the recipient. The transferor shall provide a copy of such a contract to the Executive Officer upon request. The transferor shall provide the transfer document, meeting the requirements specified in section 95423(a)(2)(B)1, to both the Executive Officer and the recipient

(D) *No Post-Transfer Modifications To Transferred Diesel Fuel By A Non-Regulated Party.*

No person to whom diesel fuel has been transferred may blend into, add anything to, or otherwise modify the diesel fuel unless that person:

1. has become the regulated party for that diesel fuel pursuant to section 95423(a)(2)(B). In this case, the regulated party (transferee or recipient) shall be responsible for complying with the LCFS regulation (including responsibility for credits and deficits) for the portion of the finished fuel that the regulated party blended, added, or otherwise modified; or

2. is under a contractual obligation with the regulated party to make the modification as specified in the contract. In this case, the regulated party (transferor) remains responsible for complying with the LCFS regulation for the entire finished fuel, including any portion that is blended, added, or otherwise

modified by the recipient.

(3) *Natural gas.* For natural gas used as a transportation fuel, the regulated parties are as follows:

(A) For CNG sold in California, the regulated party is the person or entity that provides the CNG for transportation use or is otherwise legally responsible for its quality;

(B) For LNG sold in California, the regulated party is the person or entity that provides the LNG for transportation use or is otherwise legally responsible for its quality;

(C) For biomethane sold in California, the regulated party is the person or entity that provides the biomethane for transportation use or is otherwise legally responsible for its quality;

(D) [reserved for future use]

(E) [reserved for future use]

(F) *Transfer of CNG, LNG, or Biomethane*

This provision applies only before the fuel is transferred from its "final distribution facility," which is the facility where the fuel is sold to the end user.

1. Except as provided for in section 95423(a)(3)(F)2 below, on each occasion when a person transfers custody or title of CNG, LNG, or biomethane (i.e., the transferor), the transferor of the fuel retains the LCFS compliance obligation.

2. The transferor may transfer the LCFS compliance obligation to the recipient of the fuel (i.e., the transferee) if the recipient provides to the transferor a written statement of offer to accept the compliance obligation. At this point, the recipient becomes a fuel producer under the LCFS regulation and is a regulated party responsible for the acquired fuel. The transferor shall provide the recipient and the Executive Officer a document that prominently states:

a. the volume and average carbon intensity of the transferred fuel; and

b. the recipient is now a regulated party that is responsible for the acquired fuel and for meeting the requirements of the LCFS regulation for that fuel.

(G) *No Post-Transfer Modifications To Transferred Fuel By A Non-*

Regulated Party.

No person to whom CNG, LNG, or biomethane fuel has been transferred may blend into, add anything to, or otherwise modify the fuel unless that person:

1. has become the regulated party for that fuel pursuant to section 95423(a)(3)(F)2. In this case, the regulated party (transferee or recipient) shall be responsible for complying with the LCFS regulation (including responsibility for credits and deficits) for the portion of the finished fuel that the regulated party blended, added, or otherwise modified; or

2. is under a contractual obligation with the regulated party to make the modification as specified in the contract. In this case, the regulated party (transferor) remains responsible for complying with the LCFS regulation for the entire finished fuel, including any portion that is blended, added, or otherwise modified by the recipient.

(4) *Liquefied Petroleum Gas ("LPG" or "Propane").* For LPG used as a transportation fuel, the regulated party is as follows:

(A) Except as provided for in section 95423(a)(4)(B), for LPG sold in California, the regulated party is the person or entity that provided the LPG for transportation use or is otherwise legally responsible for its quality;

(B) *Transfer of LPG and Compliance Obligation.*

This provision applies only before the fuel is transferred from its "final distribution facility," which is the facility where the fuel is sold to the end user.

1. Except in section 95423(a)(4)(B)2 below, on each occasion when a person transfers custody or title of LPG (i.e., the transferor), the transferor of the fuel retains the LCFS compliance obligation.

2. Section 95423(a)(4)(B)2 notwithstanding, the transferor may transfer the LCFS compliance obligation to the recipient (i.e., the transferee) if the recipient provides to the transferor a written statement of offer to accept the compliance obligation. At this point, the recipient becomes a fuel producer under the LCFS regulation and is a regulated party responsible for the acquired fuel. The transferor shall provide the recipient and the Executive Officer a document that prominently states:

a. the volume and average carbon intensity of the transferred

fuel; and

b. the recipient is now a regulated party that is responsible for the acquired fuel and for meeting the requirements of the LCFS regulation for that fuel.

(C) *No Post-Transfer Modifications To Transferred Fuel By A Non-Regulated Party.*

No person to whom LPG has been transferred may blend into, add anything to, or otherwise modify the fuel unless that person:

1. has become the regulated party for that fuel pursuant to section 95423(a)(4)(B). In this case, the regulated party (transferee or recipient) shall be responsible for complying with the LCFS regulation (including responsibility for credits and deficits) for the portion of the finished fuel that the regulated party blended, added, or otherwise modified; or

2. is under a contractual obligation with the regulated party to make the modification as specified in the contract. In this case, the regulated party (transferor) remains responsible for complying with the LCFS regulation for the entire finished fuel, including any portion that is blended, added, or otherwise modified by the recipient.

(5) *Electricity*. For electricity used as an on-road transportation fuel, the regulated parties are direct providers of electricity used as an on-road transportation fuel, including but not limited to, electricity Load Servicing Entities (Investor Owned Utilities and Publicly Owned Utilities).

(6) *Hydrogen*. For hydrogen used as a transportation fuel, the regulated party is as follows:

(A) For hydrogen produced onsite, the regulated party is the hydrogen refueling station owner;

(B) For hydrogen delivered to refueling stations, the regulated party is the hydrogen producer.

(b) *Determining Compliance.*

(1) *Compliance Period.* Beginning in 2010 and every year thereafter, the compliance period is January 1 through December 31 of each compliance year.

(2) *Determination of Compliance.* Compliance with the LCFS is determined annually based on the information reported in 95423(c)(1)(B).

(A) Compliance credits = $Credits^{GEN}$ + $Credits^{Balance}$ + $Credits^{Retired}$

where:
$Credits^{GEN}$ is the total gasoline plus diesel fuel credits as calculated in 95424(a)(2);

$Credits^{Balance}$ is the regulated parties' credit or deficit balance from the previous year(s);

and $Credits^{Retired}$ are credits that were purchased or otherwise acquired that are being retired for compliance with the LCFS.

(B) If compliance credits are greater than or equal to zero, the regulated party is in compliance with the LCFS.

(C) If compliance credits are less than zero, the regulated party is not compliant with the LCFS for the compliance period.

(D) If compliance credits are less than zero, and the deficit is greater than or equal to 10 percent of the regulated parties' incremental compliance obligation INC^{TOT} as calculated under 95424(a)(3), then the regulated party is in violation of the LCFS.

(E) If compliance credits are less than zero for two or more consecutive years, then the regulated party is in violation of the LCFS.

(3) *Significant Figures.* . [Under Development]

(4) *Deficit Reconciliation*. This provision applies for any compliance period in which the regulated party is in violation of the LCFS. When a violation has occurred for a compliance period (as determined by April 1st of the following year), the regulated party must meet the following requirements:

(A) If the regulated party is out of compliance, but not significantly out of compliance with the LCFS requirements, the regulated party has until December 31st of that year to fully reconcile the deficit without penalty; or

(B) If the regulated party is not compliant with the LCFS requirements, they have until December 31st of that year to fully reconcile the deficit. In addition, the regulated party is subject to penalties to the extent permitted under State law and must implement any additional measures imposed by the Executive Officer.

(C) A regulated party must clear any deficit in a given compliance period by the end of the next compliance period ("deficit-clearance period"). During the deficit-clearance period, the regulated party must meet its obligations for that period with sufficient excess credits to clear the carryover deficit.

The provisions of section 95423(b)(4)(A) and (B) notwithstanding, a regulated party that is reconciling in the current calendar year the deficit from the prior year remains responsible for meeting the LCFS requirements during the current calendar year using any of the methods specified in section 95423(b)(2).

[Commentary. This section is still under development and ARB is seeking comments on deficit reconciliation.]

(c) *Compliance and Progress Reporting Requirements.*

(1) *Reporting Frequency.* A regulated party must submit to the Executive Officer the progress reports, as defined in section 95423(c)(3), and an annual compliance report, as defined in section 95423(c)(1)(B). The reporting frequencies for these reports are set forth below:

(A) *Quarterly Progress Reports For All Regulated Parties and Credit Generators.* Beginning 2010 and each year thereafter, a regulated party (including one that only generates credits) must submit quarterly progress reports to the Executive Officer by:

1. May 31st – for the first calendar quarter covering January through March;

2. August 31st – for the second calendar quarter covering April through June;

3. November 30th – for the third calendar quarter covering July through September; and

4. February 28th (29th in a leap year) – for the fourth calendar quarter covering October through December;

(B) *Annual Compliance Reports.* By April 30th of 2011 and each year thereafter, a regulated party must provide annual compliance reports for the prior calendar year. The compliance report must meet, at minimum, the requirements outlined in Table 4. The report must also contain all calculations specified in section 94524(a); show all credits generated, acquired and used and all deficits generated pursuant to section 94523(b)(1) and (b)(2); and contain all of the following:

1. The total credits generated by the regulated party in the current year and used for compliance;

2. Any credits carried over from the previous year;

3. Any deficits carried over from the previous year;

4. The total credits acquired from another party (identify which party) used for compliance;

5. The total credits sold or otherwise transferred to other parties and to whom those credits were transferred;

6. The summation of all LCFS credits and deficits in the reporting year;

7. Any credits generated and banked in the current year, along with the balance of credits banked up to and including the current year;

8. Any deficits to be carried into the next year; and

9. Any additional information specified by the Executive Officer to be included in the report.

(2) *How To Report.* A regulated party may submit a compliance or progress report by submitting:

(A) an interactive, secured internet web-based form;

(B) a written report by email; or

(C) a written report by regular mail.

The regulated party is solely responsible for ensuring that the Executive Officer receives its progress and compliance reports by the dates specified in section 95423(c)(1). The Executive Officer shall not be responsible for delays in shipping or the failure of electronically submitted reports to be transmitted to the Executive Officer. A submitted hardcopy report must be signed by at least one person authorized by the regulated party to attest to the accuracy and validity of the report and its contents, and the report must contain a statement attesting to the report's accuracy and validity. The Executive Officer shall not deem an electronically submitted report to be valid unless the report is accompanied by a digital signature that meets the requirements of title 2, California Code of Regulations, section 22000 et seq.

The regulated party must keep and maintain all records used to support the progress reports, compliance reports, and any other information submitted to the Executive Officer for a minimum of 3 years and must provide such records within 48 hours of a request by the Executive Officer or as otherwise mutually agreed to by the Executive Officer and the regulated party.

[*Commentary*: Software *Compliance Tool. The Executive Officer is planning on developing and providing stakeholders with a software compliance tool that computes the carbon intensity of a finished fuel based on default values or custom data, where allowed. The software compliance tool will*

incorporate key characteristics of the ARB CA GREET model including default fuel pathways with provisions to allow for the generation of custom fuel pathways (upon approval), and applicable calculation methods for land use change and co-products. Additional technical features currently under consideration include an interactive graphical user-interface, a secure online data submission form for compliance or credit reporting, or a downloadable static PDF form for email submission of the report, password-protected log-in, and a searchable or indexed user guide.]

(3) *Reporting Requirements for Quarterly Progress Reports.* A regulated party must submit a quarterly progress report that meets, at minimum, the requirements outlined in Table 4.

The regulated party must determine the blendstock Average Fuel Carbon Intensity pursuant to section 95424(a)(2).

The regulated party must report all RINs retired for its facilities in California.

(A) *Additional Reporting Requirements for Gasoline and Diesel Fuel.* For each transfer of gasoline or diesel fuel that results in a transfer of the compliance obligation, the regulated party must report to the Executive Officer specific information pursuant to section 94523(a)(1) and (a)(2), whichever applies.

(B) *Additional Requirements for CNG, LNG, and LPG.* For these fuels used as transportation fuels, a regulated party must also submit the following information or take the following steps, as specified:

1. for each private access filling station, the amount of fuel dispensed (in scf) per compliance period by vehicle weight category: light/medium-duty vehicles ("LMV") and heavy-duty vehicles ("HDV"). Separate meters for each vehicle category must be installed and maintained so that the fuel dispensed amounts for each vehicle category are accurately distinguished and reported;

2. for each public access station, the fuel dispensed per compliance period by vehicle weight category (LMV and HDV). Separate meters for each vehicle category must be installed and maintained so that the fuel dispensed amounts for each vehicle category are accurately distinguished and reported;

3. for home fueling within the regulated party's service territory, the total number of homes with home fueling appliances, and the total amount of fuel dispensed to all vehicles at those homes; and

4. For LPG dispensed from a private or public access station (1 or 2 above), separate meters must be installed and maintained to

accurately distinguish and report only the amount of fuel dispensed for transportation use.

(C) *Additional Reporting Requirements for Electricity.* For electricity used as a transportation fuel, a regulated party must also submit the following:

1. For residential charging stations, the total electricity dispensed (in kWh) to all vehicles at each residence based on direct metering;

2. For each public access charging facility, the amount of electricity dispensed (in kWhr) per compliance period;

3. For each fleet charging facility, the amount of fuel dispensed (in kWhr) per compliance period.

(D) *Additional Reporting Requirements for Hydrogen.* For hydrogen used as transportation fuels, a regulated party must also submit the following:

1. For each private access filling station, the amount of fuel dispensed (in kg) by vehicle weight category: light/medium-duty vehicles (“LMV”) and heavy-duty vehicles (“HDV”).

2. For each public access filling station, the amount of fuel dispensed (in kg) by vehicle weight category: LMV and HDV.

Table 4. Checklist of reporting requirements for LCFS transportation fuels.
(R = Required, O = Optional)

Parameters to Report	Gasoline & Diesel fuel	CNG, C/LNG, LNG, LPG	Electricity	Hydrogen	Blended and Pure Fuels (i.e. E85, B20, B100, E100)
Company or organization name	R	R	R	R	R
Reporting period	R	R	R	R	R
Type of fuel	R	R	R	R	R
Blended fuel (yes/no)	R	R	R	R	R
Number of blendstocks	R	R	R	R	R
Type(s) of blendstock	R	R	R	R	R
Batch number	R	n/a	n/a	n/a	R
RIN number	R	n/a	n/a	n/a	R
Blendstock type	R	R	R	R	R
Blendstock feedstock	O	O	O	O	O
Feedstock origin	O	O	O	O	O
Production process	O	O	O	O	O
The blendstock Average Fuel Carbon Intensity ($UAFCI_i$)	R	R	R	R	R
Amount of each blendstock (MJ)	R	R	R	R	R
The average fuel carbon intensity of the finished fuel ($AFCI_{compliance}$)	R	R	R	R	R
Amount of each fuel used as gasoline replacement (MJ)	R	R	R	R	R
Amount of each fuel used as diesel fuel replacement (MJ)	R	R	R	R	R
Credits/deficits generated (tons)	R	R	R	R	R

[Commentary. ARB is seeking feedback on the feasibility of including a requirement for sustainability reporting and what that requirement should include.]

(d) *Recordkeeping and Auditing.*

(1) A regulated party must keep all of the following records for at least 3 years:
(A) Product transfer documents,
(B) copies of all data and reports submitted to the Executive Officer,
(C) records related to each fuel transaction, and
(D) records used for compliance or credit calculations.

(2) *Evidence Of Physical Pathway.* If a regulated party acquires pure ethanol or pure biomass-based diesel, the regulated party must demonstrate, through appropriate documentation such as a purchase contract, a physical pathway by which the biofuel arrives in California.

(3) *Data Verification.* All data and calculations submitted by a regulated party for demonstrating compliance or claiming credit are subject to verification by the Executive Officer or a third party approved by the Executive Officer.

(4) *Access To Facility And Data.* Pursuant to Health and Safety Code section 41510, if necessary under the circumstances, after obtaining a warrant, the Executive Officer has the right of entry to any premises owned, operated, used, leased, or rented by an owner or operator of a facility in order to inspect and copy records relevant to the determination of compliance.

(e) *Violations and Penalties.*

(1) Any failure to meet the requirements of the LCFS regulation shall constitute a violation, which includes but is not limited to: (A) the failure by a regulated party to meet a requirement specified in section 95423(b) during a compliance period; (B) failure to clear a deficit in one compliance period by the end of the next compliance period; (C) the generation or transfer of invalid LCFS credits; and (D) failure to comply with any of the reporting or recordkeeping requirements in section 95423(c) and (d).

(2) Pursuant to Health and Safety Code section 38580 (part of the California Global Warming Solutions Act of 2006), the fuels regulation penalties set forth in Health and Safety Code section 43027 shall apply, along with any other penalties permitted under State law.

(3) Pursuant to State law, any person who violates any prohibition or requirement of the LCFS is subject to civil penalties for each violation, every day during which each such violation occurs, and the amount of economic benefit or savings resulting from the violation.

Section 95424. LCFS Credits, Deficits, and Incremental Obligation

(a) *Determining Compliance Through Calculation of Credits and Deficits*

This section describes the method for determining compliance with the LCFS by calculating credits and deficits generated, and ensuring that the amount of credits earned or acquired equal or exceed the deficits incurred. All credits and deficits are denominated in units of metric tons ("MT").

(1) All LCFS fuel quantities used for credit calculation must be in energy units of megajoules (MJ).

Fuel quantities denominated in other units, such as those shown in Table 6, must be converted to MJ by multiplying by the corresponding energy density[1]:

Table 6. Energy densities of LCFS fuels and blendstocks.

Fuel (units)	Energy Density
CARBOB (gal)	119.53 (MJ/gal)
CaRFG (E10) (gal)	115.63 (MJ/gal)
Diesel fuel (gal)	134.47 (MJ/gal)
CNG (scf)	0.98 (MJ/scf)
LNG (gal)	78.83 (MJ/gal)
LPG (gal)	89.62 (MJ/gal)
Electricity (KWh)	3.60 (MJ/KWh)
Hydrogen (kg)	120.00 (MJ/kg)
Pure denatured Ethanol (gal)	80.53 (MJ/gal)
Pure Biomass-based diesel (gal)	126.13 (MJ/gal)

(2) LCFS credits/deficit are calculated according to the following equations:

$$Credits^{XD}(MT) = \left(UAFCI_{standard} - AFCI^{XD}_{compliance}\right) \times E^{XD}_{displaced} \times C \qquad (1)$$

The superscript *XD* denotes whether the credits are generated under the gasoline standard *XD*="gasoline," or the diesel fuel standard *XD*="diesel."

Section 95422 shows the applicable reference standard for each fuel.

For a provider of a blended fuel such as E10, E85, B5, B20, or two or more fuels:

[1] Energy density factors are based the lower heating values of fuels in GREET using BTU to MJ conversion of 1055 J/Btu.

$$AFCI_{acompliance}^{XD} = \frac{\sum_{i}^{n} E_i^{XD} \times UAFCI_i}{E_i^{XD} \times EER_i^{XD}} \quad \text{and} \quad (1.1)$$

$$E_{displaced}^{XD} = \sum_{i}^{n} E_i^{XD} \times EER_i^{XD} \quad (1.2)$$

For a provider of an unblended fuel such as electricity, hydrogen, CNG/LNG, or LPG:

$$AFCI_{compliance}^{XD} = \frac{UAFCI_1}{EER_1^{XD}} \quad \text{and} \quad (1.3)$$

$$E_{displaced}^{XD} = E_1^{XD} \times EER_1^{XD} \quad (1.4)$$

$$\boxed{Credits^{GEN}(MT) = Credits^{gasoline} + Credits^{diesel}} \quad (2)$$

LCFS credits are denominated in units of metric tons ("MT").
A positive value of $Credits^{GEN}$ represents credits generated.
A negative value of $Credits^{GEN}$ represents a deficit.

$Credits^{XD}(MT)$ is the amount of LCFS credits awarded (or in deficit) to a regulated party or an exempted party, in metric tons, for providing a fuel used as a gasoline substitute (XD="gasoline") or a diesel fuel substitute (XD="diesel");

$UAFCI_{standard}$ is the unadjusted average fuel carbon intensity of either the gasoline or diesel fuel standard for a given year. The standard for each year is shown in Tables 1 and 2 for gasoline and gasoline substitutes, diesel fuel, and diesel fuel substitutes in section 95421, respectively;

$AFCI_{compliance}^{XD}$ is the *adjusted* average fuel carbon intensity value reported for compliance or credit determination, in gCO2e/MJ;

$UAFCI_i$ is the unadjusted average fuel carbon intensity of each blendstock, i, determined by an ARB CA GREET fuel pathway or a custom pathway, in gCO2e/MJ;

E_i is the energy of each blendstock, in MJ, determined from the energy density conversion factors in Table 6 in section 95424(a)(1);

i is the blendstock index ;

n is the total number of blendstocks that produce a fuel;

$E_{displaced}^{XD}$ is the total amount of gasoline or diesel fuel energy displaced, in MJ per reporting period, by the use of an alternative fuel;

EER_i^{XD} is the dimensionless Energy Economy Ratio (EER), which compares the energy economy of an alternative fuel vehicle to a conventional gasoline or diesel vehicle. This term is also known as a Fuel Displacement Factor in this regulation to account for the amount of gasoline or diesel fuel that is displaced by the use of an alternative fuel. The subscript identifies the specific EER for a given fuel. For instance, $EER_{electricity}^{gasoline}$ means an EER of fuel electricity measured relative to gasoline. EER values that must be used for this regulation are listed in Table 7. *[Commentary. The term 1/EER is called the Vehicle Efficiency Adjustment factor (K), used in the previous March version of the draft regulation.]*

C is a factor used to convert credits to units of metric tons from gCO2e and has the value of

$$C = 1.0x10^{-6}\frac{(MT)}{(gCO_2e)};$$

$Credits^{GEN}$ is the total credits awarded or in deficit, in metric tons, determined from credits or deficits generated under either or both of the gasoline and diesel fuel standards.

Table 7. EER values for fuels used in light- and medium-duty (LMD), and heavy-duty (HD) applications.

Light/Medium-Duty Applications (Fuels used as gasoline replacement)			Heavy-Duty/Off-Road Applications (Fuels used as diesel replacement)		
Fuel/Vehicle Combination	**EER Values Relative to Gasoline**	**Notes**	**Fuel/Vehicle Combination**	**EER Values Relative to Diesel Fuel**	**Notes**
Gasoline (incl. E6 and E10), or E85 (and other ethanol blends)	1.0	For E85 see example A2 in Appendix A.	Diesel fuel or Biomass-based diesel blends (incl. B5, B20, & other blends)	1.0	2
CNG / LMD ICEV	1.0	See example A1, Appendix A	CNG or LNG / HD ICEV	1.0	3
LPG / LMD ICEV	1.0	4	LPG / HD ICEV	1.0	3
Electricity / LMD BEV	4.1	6	Electricity / HD BEV, PHEV, or off-road	2.7	3
Electricity / LMD PHEV	3.6	5			
H2 / LMD FCV or ICEV	2.2	6	H2 / HD FCV or ICEV	1.9	6

(BEV = battery electric vehicle, PHEV=plug-in hybrid electric vehicle, FFV = flex fuel vehicle, FCV = fuel cell vehicle, ICEV = internal combustion engine vehicle)

[2] Since all diesel and biomass-based diesel used for transportation applications are compared to the diesel standard, the EERs are assigned a value of 1.0.

[3] EER values from Table 3-11, p. 3-25, "Full Fuel Cycle Assessment: TTW Emissions and Energy Consumption" June 2007, TIAX report for the California Energy Commission. Heavy-duty values are derived from comparison to a comparable conventional diesel vehicle. Value for CNG was 0.94, LNG was 0.95, LPG was 0.94. All values are established as 1.0.

[4] EER values from Table 3-10, p. 3-24, "Full Fuel Cycle Assessment: TTW Emissions and Energy Consumption" June 2007, TIAX report for the California Energy Commission. Light-duty values are derived from comparison to a comparable conventional gasoline vehicle. Value for LPG was 1.03 in the TIAX report and is established as 1.0.

[5] PHEV EER is based on a comparison of the energy economies in electric mode versus gasoline mode of a plug-in hybrid vehicle, with an estimated 1.25 mi/MJ in the electric mode and an average of 0.35 mi/MJ in gasoline mode. EER = 1.25/0.35=3.6. This is a preliminary estimate.

[6] EER values from ARB Mobile Source Control Division (Sustainable Transportation Technologies Branch). See example A3, Appendix A for calculations and references.

(3) *Incremental Compliance Obligation.* The Incremental Compliance Obligation determines the incremental amount of reductions a regulated party must meet in each compliance period, as compared to the previous period, measured in metric tons of CO_2 equivalent.

$$INC^{XD}(MT) = \left(UAFCI_{standard}|_{n} - UAFCI_{standard}|_{n-1}\right) \times E^{XD}_{displaced}|_{n} \times C \quad (3)$$

$$INC^{TOT}(MT) = INC^{gasoline} + INC^{diesel} \quad (4)$$

The superscript *XD* denotes whether the incremental compliance obligation is required under the gasoline standard *XD*="gasoline." or the diesel fuel standard *XD*="diesel."

$INC^{XD}(MT)$ measured in metric tons is the additional reduction required between consecutive years of either the gasoline or diesel fuel compliance schedule in section 95421.

$UAFCI_{standard}|_{n}$ is the unadjusted average fuel carbon intensity of either the gasoline or diesel fuel standard for the *current compliance period*, measured in gCO2e/MJ.

$UAFCI_{standard}|_{n-1}$ is the unadjusted average fuel carbon intensity of either the gasoline or diesel fuel standard for a *previous compliance period*, measured in gCO2e/MJ.

$E^{XD}_{displaced}|_{n}$ is the same as in Eqn. 1.2 or Eqn. 1.4. It is the total amount of gasoline or diesel fuel energy displaced, in MJ for the *current compliance period*, by the use of an alternative fuel;

C is the same conversion factor used in Eqn. 1.

n is an integer that denotes the compliance period with a value ranging from 2011 to 2020.

$INC^{TOT}(MT)$ is the total incremental compliance obligation, in metric tons, for the current compliance period determined from incremental compliance obligations from either or both of the gasoline and diesel fuel standards.

(b) *Credit Generation Frequency.* Beginning 2010 and every year afterwards, a regulated party or exempted party may generate credits quarterly.

(1) For a regulated party, the total LCFS credits/deficits calculated according to Equation 2 in section 95424(a)(2) are used for determining compliance with this regulation.

(2) A regulated party claiming credits or an exempted party who voluntarily opts in to the LCFS to generate credits, must submit a compliance report meeting the reporting requirements in section 95423(c).

(c) *Credit acquisition, banking, borrowing, and trading.*

(1) If credits are traded within the LCFS market, the credits can be banked without expiration.

[Commentary. There may be limits on the credits generated in the early years (2010-2014). Staff is conducting additional analyses on the impact of capping credits generated early in the LCFS implementation.]

(2) A regulated party under the LCFS may purchase or sell LCFS credits. An exempted party may sell LCFS credits. An external 3rd party entity that is not a regulated party or an exempted party, or acting on behalf of a regulated or an exempted party, may not purchase, sell, or trade LCFS credits.

(3) LCFS credit may be exported for compliance with other greenhouse gas reduction initiatives including, but not limited to programs established pursuant to AB 32, subject to the authorities and requirements of those programs. Credits generated from outside the LCFS program including, but not limited to, those from other AB 32 programs, cannot be used in the LCFS.

(4) Borrowing or the use of credits from anticipated future carbon intensity reductions is not allowed.

(5) Offsets from transportation fuels not regulated by the LCFS, such as emissions reduction from aviation or non-regulated marine fuels, are not allowed.

Section 95425. Determination of Carbon Intensity Values

(a) *Overview and General Requirements.*

(1) This section presents the methods (Method 1 and Method 2) for determining a regulated party's compliance with the carbon intensity requirements. In addition to meeting the requirements specified in this section, the regulated party must use the detailed procedures as shown in Appendices A and B, which are appended to this regulation. These procedures provide additional details on the derivation and use of the calculated carbon intensity values pursuant to the LCFS regulation.

(2) Pursuant to this section, a regulated party selects a method commensurate with the party's ability to document its full fuel-cycle analysis. Higher levels of scientifically defensible documentation are rewarded with more options to choose from and lower carbon intensity values; conversely, lower levels of documentation yield fewer options and higher calculated carbon intensity values.

(3) The selected method is subject to approval by the Executive Officer, and the method must be consistent with that method's documentation and other requirements.

(4) Using the appropriate method, the regulated party calculates the party's blendstock carbon-intensity value, as provided for in this section. This value is calculated for each blendstock's fuel pathway in a source-to-wheel, full fuel-cycle analysis conducted pursuant to an established standard approach, a pre-approved modification to the standard approach, or a pre-approved alternative approach.

(b) *Selection of Method.*

For purposes of complying with this regulation, a regulated party must choose one of the following methods (Method 1 or Method 2) for determining its fuel's carbon intensity value. Failure of a regulated party to declare, upon request by the Executive Officer, which of the two methods the regulated party used to determine the fuel's carbon intensity will result in the Executive Officer using Method 1 (ARB Lookup Table) to calculate the fuel's carbon intensity value, as specified below.

(1) *Method 1 – ARB Lookup Table.*

(A) This method uses the California-modified GREET model (version 1.8b as of [insert date]), which is incorporated herein by reference. This model is available for downloading on ARB's internet site.

(B) *Lookup Table Fuel Pathways and Land Use Modifiers.*

A regulated party using Method 1 must run the online interface tool to

generate results from the GREET and GTAP models. Initial carbon intensity values are derived from the California-modified GREET model (version 1.8b as of [insert date] and GTAP ver. XX are incorporated herein by reference.

The carbon intensity lookup tables are incorporated herein by reference and will be available on ARB's internet site.

[Commentary: GREET v. 1.8b currently does not incorporate GTAP. The final version of the interface tool will incorporate both GREET and GTAP.]

(C) *Conventional Fuels.*

1. For conventional fuels (gasoline (including CARBOB) and diesel fuel) derived from conventional crude oil, the regulated party must use the average fuel-pathway carbon-intensity value for that fuel derived from the California-modified GREET ("conventional crude CI").

2. For conventional fuels derived from non-conventional crude oil, the regulated party must calculate its fuel's carbon intensity ("non-conventional crude CI") by one of the methods provided in section 95425(b). Production of any conventional fuel from non-conventional crude creates a rebuttable presumption that the fuel's non-conventional crude CI value is more than 10% greater than the conventional crude CI value. The presumed non-conventional crude CI value shall be the greater of the regulated party's calculated value and the Executive Officer's calculated value for the non-conventional crude CI. This presumption is rebuttable only as follows:

   a. *Non-Conventional Crude CI Within 10% Of Conventional Crude CI*. A regulated party providing conventional fuel derived from non-conventional crude may use the conventional crude CI value, as provided in section (b)(1)(C)1 above, only if both the regulated party's claimed non-conventional crude CI value and the Executive Officer's calculated non-conventional crude CI value are within 10 percent of the conventional crude CI value;

   b. *Non-Conventional Crude CI More Than 10% Lower Than Conventional Crude CI.* If either the Executive Officer's or the regulated party's calculated non-conventional crude CI values is more than 10% lower than the conventional crude CI value, the presumed carbon intensity value shall be equal to whichever calculated value is closer to the conventional crude CI value. The regulated party may use its own calculated non-conventional crude CI value only if the party

has demonstrated, to the Executive Officer's written satisfaction, the validity of the party's claimed non-conventional crude CI value. No such claimed non-conventional crude CI value may be approved by the Executive Officer without adequate documentation from the regulated party to support such a claim. Upon the Executive Officer's review and approval of the documentation, the regulated party must use the custom carbon-intensity value approved by the Executive Officer for that fuel.

c. *Non-Conventional Crude CI More Than 10% Greater Than Conventional Crude CI.* If either the Executive Officer's or the regulated party's calculated non-conventional crude CI values is more than 10% greater than the conventional crude CI value, the presumed carbon intensity value shall be equal to whichever calculated value is farther from the conventional crude CI value. The regulated party may use its own calculated non-conventional crude CI value only if the party has demonstrated, to the Executive Officer's written satisfaction, the validity of the party's claimed non-conventional crude CI value. No such claimed non-conventional crude CI value may be approved by the Executive Officer without adequate documentation from the regulated party to support such a claim. Upon the Executive Officer's review and approval of the documentation, the regulated party must use the custom carbon-intensity value approved by the Executive Officer for that fuel.

(D) *Alternative Fuels (CNG, LNG, LPG, Hydrogen, Electricity, Biomass-based Diesel Blend, Ethanol Blends, E100, and B100)*

For any fuel other than the conventional fuels, the regulated party must use the values shown in CI Lookup Tables for that fuel as provided below, unless the regulated party chooses to use Method 2 as provided for in subsection (b)(2).

Except as provided for in subsection (b)(2), the regulated party must use the default method (Method 1) as shown in the Lookup Tables. A sample lookup table (for corn ethanol) is provided for in Appendix B and incorporated herein by reference.

(2) *Method 2 – Customized Lookup Table Values (Modified ARB Method).*

This method uses Method 1 modified with one or more inputs proposed for customization by the regulated party (proponent) as approved by the Executive Officer. Inputs variables that are identified as invariant input parameters in Appendix C may not be modified by a proponent-regulated party; such modifications may be used upon approval by the Executive Officer. The modified GREET inputs must reflect the conditions specific to the

proponent-regulated party's production/marketing process. A proponent-regulated party may not introduce a new input (e.g., refinery efficiency) that is not already incorporated in the California-modified GREET (v. 1.8b) and identified as an invariant parameter as specified above.

(c) *Scientific Defensibility, Burden of Proof, the "10-10" Substantiality Requirement, and Data Submittal Procedures for Approval of Method 2.*

For a proposed Method 2 to be approved by the Executive Officer, the proponent-regulated party must demonstrate that the method is both scientifically defensible and meets the substantiality requirement, as specified below:

(1) *Scientific Defensibility and Burden of Proof.* A regulated party that proposes to use Method 2 bears the sole burden of demonstrating to the Executive Officer's written satisfaction, with clear-and-convincing evidence, that the proposed method is scientifically defensible.

(A) For purposes of this regulation, "scientifically defensible" means the method has been demonstrated to the Executive Officer as being at least as valid and robust as Method 1 for calculating the fuel's carbon intensity.

(B) Proof that a proposed method is scientific defensible includes, but is not limited to, publication of the proposed Method 2 in a major, well-established and peer-reviewed scientific journal (*Science, Nature, Journal of the Air and Waste Management Association, Proceedings of the National Academies of Science*, etc.).

(C) The Executive Officer shall provide a minimum 30-day public review process for any Method 2 proposed for the Executive Officer approval before such approval can be granted.

(2) *"10-10" Substantiality Requirement.* The regulated party must obtain approval from the Executive Officer of the proposed Method 2 before the party can use Method 2 to demonstrate compliance with the LCFS regulation. In seeking the Executive Officer's approval, the regulated party must demonstrate, with clear-and-convincing evidence, that the proposed method meets both of the following substantiality requirements:

(A) Method 2 yields an overall blendstock carbon intensity that is lower than the value calculated using Method 1 by more than 10%; and

(B) The regulated party can and will produce more than 10 million gasoline gallon equivalent per year (1,156 MJ) of the regulated fuel.

(3) *Data Submittal Process.* A regulated party proposing Method 2 for a fuel's carbon intensity value may use the Software Compliance Tool (as published on ARB's internet site), or any other tool determined by the Executive Officer as equivalent, to generate a custom or alternative fuel pathway for use in the

California-modified GREET model (v. 1.8b).

(A) The proponent party must provide all supporting documentation to enable the Executive Officer to verify how the carbon intensity value was derived.

(B) The proponent must submit all relevant data and calculations to the Executive Officer by electronic submission, such as via email or an online web-based interface, when available.

(C) The proponent must not convert spreadsheets containing formulas into other file formats. All custom or alternative carbon intensity values must be reviewed and approved by the Executive Officer prior to submission of such values by the regulated or exempt party for compliance, credit generation, or reporting purposes.

(4) *Unrestricted Public Use of Submitted Data, Pathways, Models, and Carbon Intensity Values.* A regulated party that submits any data to the Executive Officer in support of a proposed Method 2 must also submit a written declaration clearly stating that the party understands and agrees to the following:

(A) all information submitted pursuant to this section will be disclosed and become publicly available information (i.e., public domain); and

(B) all carbon intensity values, associated parameters, and other related information obtained or derived from all such submittals will be incorporated by the Executive Officer into the Lookup and Customized Tables for use on a free, unlimited license, and otherwise unrestricted basis by any regulated, as provided for in this regulation.

[Commentary. Information subject to this provision includes, but is not limited to, information on pathways, customized input values, models, and any other carbon intensity-related data, including the carbon-intensity values themselves]

Section 95426. Requirements for Multimedia Evaluation

(a) *Pre-Sale Approval Requirement.*

Except as provided for in section 94526(e), a regulated party may not sell, supply, distribute, import, offer for sale, or offer for use in California a regulated fuel unless one of the following conditions has first been met:

(1) a multimedia evaluation for the regulated fuel has been conducted pursuant to the requirements specified in this regulation, and that evaluation has been approved by the Air Resources Board; or

(2) a multimedia evaluation for the regulated fuel has been conducted, and that evaluation was approved by the Executive Officer prior to the date the Office of Administrative Law (OAL) approves the LCFS regulation.

(b) *[reserved for future use]*

(c) *[reserved for future use]*

(d) *Requirements.*

(1) The Executive Officer, or his or her designee, shall not approve a multimedia evaluation subject to this section unless the evaluation has undergone the process for review and approval specified in Health and Safety section 43830.8, including but not limited to, receiving peer review and approval by the California Environmental Policy Council pursuant to Health and Safety section 43830.8(d)-(g). For purposes of Health and Safety section 43830.8(a), each Executive Officer approval of a regulated fuel for compliance with the LCFS regulation under section 94526(a)(1) shall constitute compliance with the requirement in Health and Safety section 43830.8(a) for conducting a multimedia evaluation prior to adoption of a "regulation that establishes a specification for motor vehicle fuel."

(2) All multimedia evaluations subject to this section shall be evaluated in accordance with the Cal/EPA guidance document entitled, *Guidance Document and Recommendations on the Types of Scientific Information Submitted by Applicants for California Fuels Environmental Multimedia Evaluations* (June 2008), which can be downloaded at http://www.arb.ca.gov/fuels/multimedia/080608guidance.pdf.

(e) *Exemptions.*

(1) *Negative Declaration For ARB-Adopted New Or Amended Fuel Specifications.*

The requirements of this section do not apply to a regulated fuel if:

(A) the regulated fuel is subject to a proposed ARB regulation establishing a new or amending an existing fuel specification, which ARB adopts after the date OAL approves the LCFS regulation; and

(B) the California Environmental Policy Council, following an initial evaluation of the proposed regulation, conclusively determines that the regulation will not have any significant adverse impact on public health or the environment.

(2) *CaRFG, Diesel Fuel, E10, E85, CNG, LNG, LPG, and Electricity.*

The requirements of this section do not apply to a regulated fuel if:

(A) the fuel is subject to an ARB-adopted fuel specification; and

(B) The Executive Officer does not amend that fuel specification after OAL approves the LCFS regulation.

Fuels subject to this provision include CaRFG, diesel fuel, E10, E85, CNG, LNG, LPG, and electricity. This provision applies only to the extent that the Executive Officer does not amend the fuel specification for any of the above fuels. When OAL approves an ARB amendment to a fuel specification identified above, this provision shall no longer apply for that fuel.

(3) *Biodiesel, Renewable Diesel, and Hydrogen.*

The requirements of this section do not apply to a regulated fuel that:

(A) is subject to the Division of Measurement Standards' Engine Fuels Standards (4 CCR §4140 et seq.); but

(B) is not subject to an ARB-adopted fuel specification.

Fuels subject to this provision include biodiesel, renewable diesel, and hydrogen. This provision applies only to the extent that the Executive Officer does not adopt a fuel specification for any of the above fuels. When OAL approves an ARB-adopted fuel specification for a fuel identified above, this provision shall no longer apply for that fuel.

Section 95427. Definitions

[Commentary. The following are preliminary definitions for the terms used in this draft regulation. ARB staff is seeking comments on all the definitions.]

"Alternative fuels" collectively refers to natural gas (CNG, LNG, biomethane), LPG, electricity, hydrogen, an ethanol blend, a biomass-based-diesel blend, B100, and E100.

> "B100" means biodiesel meeting ASTM D6751-07be1 (*Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*).
>
> "E100," also known as "Denatured Fuel Ethanol," means nominally anhydrous ethyl alcohol meeting ASTM D4806-08 (*Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel*).

"Biomass-based diesel" means a biodiesel (mono-alkyl ester) or a renewable biodiesel that complies with ASTM D975. This includes a renewable fuel derived from co-processing biomass with a petroleum feedstock.

> "Biodiesel" means a diesel fuel substitute produced from nonpetroleum renewable resources that meet the registration requirements for fuels and fuel additives established by the Environmental Protection Agency under section 211 of the Clean Air Act. It includes biodiesel meeting the following:
>
> (1) Registered as a motor vehicle fuel or fuel additive under 40 CFR part 79.
> (2) A mono-alkyl ester.
> (3) Meets ASTM D-6751-07, entitled "Standard Specification for Biodiesel Fuel Blendstock (B100) for Middle Distillate Fuels."
> (4) Intended for use in engines that are designed to run on conventional diesel fuel.
> (5) Derived from nonpetroleum renewable resources (as defined in paragraph (m) of this section).
>
> "Renewable diesel" means a motor vehicle fuel or fuel additive which is all the following:
>
> (1) Registered as a motor vehicle fuel or fuel additive under 40 CFR Part 79.
> (2) Not a mono-alkyl ester.
> (3) Intended for use in engines that are designed to run on conventional diesel fuel.
> (4) Derived from nonpetroleum renewable resources.

"Biomethane" means pipeline-quality gas derived from biomass as defined by the California Energy Commission (CEC), which includes any organic material not derived from fossil fuels, including agricultural crops, agricultural and forestry

wastes and residues, and construction wood wastes, among others.

“Blendstock” means the blending component(s) that produce a finished fuel used in a motor vehicle. Each blendstock corresponds to a fuel pathway in the ARB CA GREET. A blendstock that is used directly in a vehicle is considered a finished fuel.
“Carbon intensity” means the amount of greenhouse gas emissions, measured on a lifecycle basis, per unit of energy of fuel delivered. In this regulation, the units used are grams of carbon dioxide equivalent per megajoule (gCO2e/MJ).

“Co-products” means a secondary product, typically with economic value, produced as a result of the process of producing transportation fuels.

“Credits/deficits” is the mass of CO2e, measured in metric tons, calculated from the difference between an allowed emissions, set by either the gasoline or diesel standard, and the actual emissions generated by the use of a regulated fuel. A credit is generated when the actual emissions is less than the allowed emissions. A deficit is generated when the actual emissions is greater than the allowed emissions. In the LCFS, the total credit, calculated from the sum of credits generated under the gasoline and diesel groups, is used for the determination of compliance.

“Crude Oil”

> “Conventional crude oil” means a crude oil produced by a primary, secondary, or tertiary oil recovery process.
>
> “Non-conventional crude oil” means a crude oil produced from oil sands, tarsands, oil shale, or processes such as gas-to-liquid (GTL) and coal-to-liquid (CTL).

“Dedicated fuel vehicle” means a vehicle that uses a single external source of fuel for its operation. The fuel can be a pure fuel such as gasoline or a blended fuel such as E85 or B20. A dedicated fuel vehicle has one fueling port onboard the vehicle. Examples include BEV, E85 FFV, diesel running on B5 or B20, and grid-independent hybrids such as a Prius.

“Finished fuel” means a fuel that is used directly in a vehicle for transportation purposes without requiring additional chemical or physical processing.

“HDV” means a heavy-duty vehicle that is rated at 14,001 or more pounds gross vehicle weight rating (GVWR).

“Home Fueling” means an appliance that is located on or within a residential property with access limited to a single household.

“Lifecycle Greenhouse Gas Emissions” means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and

feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential.
(From Section 211(o)(1) of the Clean Air Act)

"LMV" means a vehicle category that includes both light-duty (LDV) and medium-duty vehicles (MDV).

"LDV" means a vehicle that is rated at 8500 pounds or less GVWR.
"MDV" means a vehicle that is rated between 8501 and 14,000 pounds GVWR.

"Motor vehicle" has the same meaning as defined in section 415 of the Vehicle Code.

"Multi-fuel vehicle" means a vehicle that uses two or more distinct fuels for its operation. A multi-fuel vehicle (also called a vehicle operating in blended-mode) includes a bi-fuel vehicle and can have two or more fueling ports onboard the vehicle. A fueling port can be an electrical plug or a receptacle for liquid or gaseous fuel. As an example, a plug-in hybrid hydrogen ICEV uses both electricity and hydrogen as the fuel source and can be "refueled" using two separately distinct fueling ports.

"Multimedia evaluation" has the same meaning as specified in H&S §43830.8(b) and (c).

"Private Access" means a fueling pump with access restricted to privately distributed electronic cards ("cardlock") or is located in a secure area not accessible to the public.

"Public Access" means a fueling pump that is accessible to the public.

"Pure denatured ethanol," also known as "denatured fuel ethanol," (E100) means nominally anhydrous ethyl alcohol meeting ASTM D4806-08 (*Standard Specification for Denatured Fuel Ethanol for Blending with Gasoline for Use as Automotive Spark-Ignition Engine Fuel*).

"Racing vehicle" means a competition vehicle not used on city streets.

"Regulated fuel" means a fuel, for use in a motor vehicle, which is subject to this regulation.

"Regulated party" means a refiner, importer, producer, or provider of a transportation fuel in California subject to this regulation.

[Commentary. The following definition comes from section 201 of Energy Independence and Security Act of 2007. ARB staff is seeking comments on the appropriateness and necessity of including this definition and how it might be used in the LCFS.]

"Renewable Biomass" means each of the following:

(i) Planted crops and crop residue harvested from agricultural land cleared or cultivated at any time prior to the enactment of this sentence that is either actively managed or fallow, and nonforested.

(ii) Planted trees and tree residue from actively managed tree plantations on non-federal land cleared at any time prior to enactment of this sentence, including land belonging to an Indian tribe or an Indian individual, that is held in trust by the United States or subject to a restriction against alienation imposed by the United States.

(iii) Animal waste material and animal byproducts.

(iv) Slash and pre-commercial thinnings that are from non-federal forestlands, including forestlands belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the United States, but not forests or forestlands that are ecological communities with a global or State ranking of critically imperiled, imperiled, or rare pursuant to a State Natural Heritage Program, old growth forest, or late successional forest.

(v) Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire.

(vi) Algae.

(vii) Separated yard waste or food waste, including recycled cooking and trap grease.

"Transportation fuel" means any fuel used or intended for use as a motor vehicle fuel, other than racing fuel. In addition, "transportation fuel" includes diesel fuel used or intended for use in nonvehicular sources other than the following:

(1) Locomotives, other than diesel electric intrastate locomotives as defined in title 17, California Code of Regulations, section 93117; and

(2) Marine vessels, other than harborcraft as defined in title 17, California Code of Regulations, section 93117.

APPENDIX A. Calculations of Energy Economy Ratios (EER)

Example A1: Calculation of CNG EER

Fuel Economy (miles per gallon gasoline equivalent)

			Gasoline	Gasoline	CNG	CNG
Model Year	**Vehicle Make**	**Model**	**City**	**HWY**	**City**	**HWY**
2008	Honda	Civic	25	36	24	36
		Average	30.5		30.0	

Source of mpg values: US EPA Fuel Economy Guide 2008

CNG Adjustment Factor Calculation

Fuel	mpg (gasoline equiv.)	EER
Gasoline	30.5	1
CNG	30.0	**0.98**

EER= 30.0/30.5 = 0.98 for CNG/LMD

The EER value is established as 1.0 due to uncertainties in the data.

Example A2: Calculation of E85 FFV EER

Fuel Economy in miles per gallon

	Vehicle			Gasoline	Gasoline	E85	E85
Model Year	**Make**	**Model**	**Engine**	**City**	**HWY**	**City**	**HWY**
2008	Chrysler	Sebring Convertible		18	26	13	19
2008	Mercedez	C300		18	25	13	19
2008	Chrysler	Sebring Convertible		19	27	13	20
2008	Dodge	Avenger		19	27	13	20
2008	Chevrolet	Impala	3.5/6	18	29	14	21
2008	Chevrolet	Impala	3.9/6	18	28	13	20
2008	Ford	Crown Victoria		15	23	11	16
2008	Lincoln	Town Car		15	23	11	16
2008	Mercury	Marquis		15	23	11	16
2008	Chevrolet	Silverdado PU (average)		14.5	19.5	11	14.5
2008	Dodge	Dakota Pickup (average)		14	19	9	12
2008	Dodge	Ram 1500 PU (average)		13	17.5	9	12
2008	Ford	F150 PU (average)		13	17.5	9.5	12.5
2008	GMC	Sierra (average)		14.5	19.5	11	14.5
2008	Mitsubishi	Raider Pickup (average)		14	19	9	12
2008	Nissan	Titan (average)		12	17	9	12.5
2008	Chevrolet	Van 1500		12	16	9	12
2008	GMC	Savana 1500		12	16	9	12
2008	Chevrolet	Express 1500		12	16	9	12
2008	GMC	Savana 1500		12	16	9	12
2008	Chevrolet	Uplander		16	23	12	17
2008	Chrysler	Town and Country		17	24	11	17
2008	Dodge	Caravan		17	24	11	17
2008	Chevrolet	Avalanche 1500		14	19.5	11	14.5
2008	Chevrolet	Suburban		14	19.5	11	14.5
2008	Chevrolet	Tahoe 1500		14	19.5	11	14.5
2008	Chrysler	Aspen		13.5	18	9	12
2008	Dodge	Durango		13.5	18	9	12
2008	GMC	Yukon 1500		14	19.5	11	14.5
2008	Jeep	Commander		13.5	18.5	9	12.5
2008	Jeep	Grand Cherokee		14	19	9	12.5
2008	Nissan	Armada		12	17.5	9	13
			avg.	14.7	20.8	10.6	14.9
			avg City and HWY	17.7		12.7	

Source of mpg values: US EPA Fuel Economy Guide 2008

E85 Adjustment Factor Calculation

Fuel	mpg	LHV (Btu/gal)	Btu/mi	Adjustment Factor	EER
Gasoline	17.7	111289	6278	1	
Ethanol		76330			
E85	12.7	81573.85	6410	1.02	**0.98**

Note: LHVs are from GREET Fuel Specs

LHV_E85 = 0.85*LHV_Ethanol+0.15*LHV_Gasoline

The EER value is established as 1.0 due to uncertainties in the data.

Example A3: Calculation of Hydrogen ICE, FC, and BEV EERs

For light-duty EV and FCV

Comparison of different compact cars
mostly 4-door sedans with automatic transmissions

Vehicle type	Year/make/model	Mileage (mpg or mpgge) City	Hwy	Combined	Relative to gasoline multiplier
Electric	2001 Ford Think	106	83	**94**	
	2001 Nissan Hypermini	120	94		
	2002 Ford Explorer	63	47	**55**	
	1996 GM EV1			**155**	
	2008 Tesla Roadster			**160**	
	2008 AC Propulsion eBox			**130**	
	2002 Toyota RAV 4	125	100	**112**	
	2000 Nissan Altra	117	130	**123**	**4.1**
	Average			**122**	(=122/30)
FCVs	2005 Ford Focus (1)			52	
	2005 F-Cell	57	58	57	
	2005 Honda FCX (2)	62	51	57	**2.2**
	Average			**56**	(=56/25)

Gasoline reference	2006 Honda Civic	26	36	30	
	2006 Honda Accord	23	31	26	
	2007 Lexus GS 350	19	26	22	
	2006 Toyota Camry	21	31	25	
	2006 Chrysler Sebring	20	27	22	
	2006 Dodge Stratus	20	27	22	
	2006 Ford Taurus	18	25	20	
	2007 Chevy Impala	18	28	22	
	2007 Mercedes C230	17	23	19	
	2003 Toyota RAV 4	21	26	23	
	2005 Ford Focus	22	29	25	
	Ford P2000 gasoline equiv				
Gas subcompacts	2007 Honda Fit	27	35	30	
comp. to FCX and F-Cell	2007 Toyota Yaris	29	35	31	
that are available in US	**2006 Scion xA**	**27**	**35**	**30**	
	Average			**25**	

Notes:

Fuel Economy data from EPA Fuel Economy database: fueleconomy.gov unless otherwise noted

(1) mpgge based on data collected by Ford and their customers, USEPA rating may be higher

(2) USEPA fuel Economy rating from 2003
www.fueleconomy.gov/feg/noframes/17329.shtml
www.fueleconomy.gov/feg/noframes/17331.shtml
www.fueleconomy.gov/feg/noframes/18291.shtml
www.fueleconomy.gov/feg/noframes/18290.shtml
www.fueleconomy.gov/feg/noframes/16423.shtml
cars are varying size not necessarily comparable

For heavy-duty H2		relative to diesel fuel multiplier
hydrogen ICE bus	4.96 mgdge	4.96/4.03 = **1.2**
hydrogen FC bus (average)	7.65 mpdge	7.65/4.03 = **1.9**
diesel bus	4.03 mpg	

an NREL report shows the values for Fuel Cell Buses and HICE buses below
Fuel Cell buses have 6.97 to 8.33 mile per diesel gallon equivalent (average of 7.65)
Hydrogen ICE bus around 4.96 mpdge
Diesel bus 4.03 mpg
http://www.nrel.gov/hydrogen/pdfs/42665.pdf
So an EER from these numbers would be 1.9 for FCB's, 1.2 for HHICE's

APPENDIX B. Sample Carbon Intensity Look-up Table

Table B1. Carbon intensity lookup table using Method 1 for corn ethanol.
Default carbon intensity value (labeled XX) to be provided by the Executive Officer.

Fuel	Feedstock	Feedstock Origin	Processing Characteristics
Ethanol (XX_{O1})	Corn (XX_{O2})	US Midwest (XX_{O3A})	Dry Mill, Natural Gas Fueling (XX_{O4A})
			Dry Mill, Natural Gas and Biomass Fueling (XX_{O4B})
			Dry Mill, Natural Gas and Coal Fueling (XX_{O4C})
			Dry Mill, Custom Selected Fueling (XX_{O4D})
			Wet Mill, Natural Gas Fueling (XX_{O4E})
			Wet Mill, Natural Gas and Biomass Fueling (XX_{O4F})
			Wet Mill, Natural Gas and Coal Fueling (XX_{O4G})
			Wet Mill, Custom Selected Fueling (XX_{O4H})
		US Other Regions (XX_{O3B})	Dry Mill, Natural Gas Fueling (XX_{O4I})
			Dry Mill, Natural Gas and Biomass Fueling (XX_{O4J})
			Dry Mill, Natural Gas and Coal Fueling (XX_{O4K})
			Dry Mill, Custom Selected Fueling (XX_{O4L})
			Wet Mill, Natural Gas Fueling (XX_{O4M})
			Wet Mill, Natural Gas and Biomass Fueling (XX_{O4N})
			Wet Mill, Natural Gas and Coal Fueling (XX_{O4O})
			Wet Mill, Custom Selected Fueling (XX_{O4P})

* (XX) represents carbon intensity value calculated using ARB CA GREET.

For example, if Company Y is a regulated party that sells corn ethanol fuel in compliance with the LCFS regulation. Company Y has documentation that shows the corn ethanol is produced in the U.S. Midwest region using a wet mill, natural gas & biomass-fueled process. From the table above, Company Y will use the carbon intensity value denoted by "XX_{O4F}."

APPENDIX C. Invariant Parameters in GREET

The following list of parameters in GREET cannot be modified under Method 2, Customized Lookup Table approach.

[under development]

APPENDIX D. Determining LCFS Compliance by Calculating the Amount of Credit/Deficits Generated

LCFS compliance is determined by a comparison of the total emissions from the use of a fuel to the emissions from a standard fuel. The net emission, also known as the LCFS credit or deficit, is the extent to which the fuel is in compliance.

The LCFS credit/deficit calculation measures the difference between the total emissions allowed by the use of the conventional gasoline or diesel fuel in the LCFS standard and the actual emissions generated by the use of a fuel. The total allowed emissions includes a fuel displacement factor, represented by the Energy Economy Ratio (EER) of a fuel, and reflects the amount of conventional fuel energy that is displaced by the use of that fuel.

In general, credit can be represented by

$$Credits^{XD} = EmissionsAllowed^{XD} - ActualEmssions^{XD}$$

(The superscript *XD* denote whether the credits are generated under the gasoline standard *XD*="gasoline", or the diesel standard *XD*="diesel fuel").

$EmissionsAllowed^{XD}$ is the emissions from the conventional fuel if it is replaced by the use of an alternative fuel.

In other words,

$$EmissionsAllowed^{XD} = \begin{pmatrix} \text{AFCI of the Displaced} \\ \text{Conventional Fuel} \end{pmatrix} \times \begin{pmatrix} \text{Amount of Energy} \\ \text{Displaced} \end{pmatrix}$$

In terms of variables,

$$EmissionsAllowed^{XD} = (UAFCI_{standard})(E_{actual}^{XD})(EER_{actual}^{XD})(C) \qquad \text{(A1)}$$

where

$UAFCI_{standard}$ is the unadjusted carbon intensity of either the gasoline or diesel standard in gCO2e/MJ. This value is provided in the LCFS compliance schedule Tables 1 and 2;

E_{actual}^{XD} is the total amount of energy supplied, in *MJ per reporting period,* of the fuel that is used to displace gasoline or diesel fuel. For instance, if 1000 MJ of electricity is supplied for transportation use in light-duty vehicle applications, E_{actual}^{XD} = $E_{electricity}^{gasoline} = 1000MJ$;

EER_{actual}^{XD} is the dimensionless Energy Economy Ratio which compares the fuel economy of an alternative fuel to a comparable conventional gasoline or diesel vehicle. This term is also called the Fuel Displacement Factor in the LCFS. The subscript identifies the specific EER for a given fuel. For instance, $EER_{electricity}^{gasoline}$ means an EER of fuel electricity measured relative to gasoline;

C is the unit conversion factor with the value $C = 1.0x10^{-6}\,\frac{(MT)}{(gCO_2e)}$ to put credits in units of metric tons;

Notice that the term $\left(E_{actual}^{XD}\right)\left(EER_{actual}^{XD}\right)$ in Eqn. A1 accounts for the energy that is displaced if an alternative fuel is used. For electricity [7] with an $EER_{electricity}^{gasoline}$ of 4.1, for instance, the term $\left(E_{electricity}^{gasoline}\right)\left(EER_{electricity}^{gasoline}\right)$ represents the amount of gasoline that would be displaced by the use of the electricity. In other words, for 1 unit of electricity energy used in an electric vehicle, 4.1 units of gasoline are displaced when used in a conventional gasoline vehicle.

$ActualEmissions^{XD}$ is the actual emission of the fuel when it is used;

$$ActualEmissions^{XD} = \left(UAFCI_{actual}\right)\left(E_{actual}^{XD}\right)(C) \qquad \text{(A2)}$$

where $UAFCI_{actual}$ is the unadjusted carbon intensity of the fuel, in gCO2e/MJ, determined from an energy-weighted average of the carbon intensity of the blending components. The carbon intensities of the blending components are determined from ARB lifecycle analysis.

Putting Eqns. A1 and A2 together,

$$Credits^{XD}(MT) = \left(UAFCI_{standard}\right)\left(E_{actual}^{XD}\right)\left(EER_{actual}^{XD}\right)(C) - \left(UAFCI_{actual}\right)\left(E_{actual}^{XD}\right)(C)$$

and rearranging the terms

$$Credits^{XD}(MT) = \left(UAFCI_{standard} - UAFCI_{actual} \times \frac{1}{EER_{actual}^{XD}}\right) \times \left(E_{actual}^{XD}\right)\left(EER_{actual}^{XD}\right) \times (C) \qquad \text{(A3)}$$

where $E_{displaced}^{XD} = \left(E_{actual}^{XD}\right)\left(EER_{actual}^{XD}\right)$ is the amount of energy displaced and

$AFCI_{actual}^{XD} = UAFCI_{actual} \times \frac{1}{EER_{actual}^{XD}}$ is the *adjusted* carbon intensity of the fuel.

[7] Values used here are for illustration only and may differ from those in Table 7.

Eqn. A3 can, therefore, be rewritten as

$$Credits^{XD}(MT) = \left(UAFCI_{s\tan dard} - AFCI^{XD}_{actual}\right) \times \left(E^{XD}_{displaced}\right) \times (C)$$

It is important to note that $AFCI^{XD}_{actual}$ is used for compliance reporting and credit determination.

To indicate that the $AFCI^{XD}_{actual}$ is used for compliance, $AFCI^{XD}_{actual}$ is labeled as $AFCI^{XD}_{acompliance}$.

The credit equation can now be written as

$$\boxed{Credits^{XD}(MT) = \left(UAFCI_{s\tan dard} - AFCI^{XD}_{compliance}\right) \times \left(E^{XD}_{displaced}\right) \times (C)} \quad \text{(A4)}$$

Notice the 1/EER term in Eqn. A3 is the vehicle efficiency adjustment factor, K, in the March Concept Outline.

To determine compliance with this regulation, all credits for gasoline and diesel are summed.

$$\boxed{Credits^{GEN}(MT) = Credits^{gasoline} + Credits^{diesel}} \quad \text{(A5)}$$

For a provider of a blended fuel such as E10 or a provider of multiple fuels,

$AFCI^{XD}_{compliance}$ and $E^{XD}_{displaced}$ terms in Eqn. A4 can be written as

$$\boxed{AFCI^{XD}_{acompliance} = \frac{\sum_i^n E_i^{XD} \times UAFCI_i}{E_i^{XD} \times EER_i^{XD}}} \text{ and} \quad \text{(A4.1)}$$

$$\boxed{E^{XD}_{displaced} = \sum_i^n E_i^{XD} \times EER_i^{XD}} \quad \text{(A4.2)}$$

For a provider of an unblended fuel such as electricity, the equations above simplify to

$$\boxed{AFCI^{XD}_{compliance} = \frac{UAFCI_1}{EER_1^{XD}}} \text{ and} \quad \text{(A4.3)}$$

$$\boxed{E^{XD}_{displaced} = E_1^{XD} \times EER_1^{XD}} \quad \text{(A4.4)}$$

The $Credits^{XD}$ is based on the amount of displaced standard fuel. For instance, if electricity was used to replace gasoline, the credit calculated above is the credit based on the amount of gasoline energy that would have been used if it was used in a comparable conventional gasoline vehicle.

Notice that Eqn. A3 is simply the original credit equation proposed in the March Concept Outline multiplied by EER. Therefore,

$$Credits^{XD}(MT) = \left\{OriginalCredit^{XD}\right\} \times \left(EER_1^{XD}\right)$$

For each fuel, the total credit is the amount of credit generated by replacing gasoline and/or diesel fuel. Eqn. A4 can be used to separately calculate the credit used to displace gasoline (XD="gasoline") and credit used to displace diesel fuel (XD="diesel"). The total credit is the sum of the credit determine from each category.

Comparison of changes in the credit calculation.

The following table summarizes the changes made to the credit calculations and compares the changes to the calculations presented in the March Concept Outline.

Table B1. Comparison of changes made in the credit calculation methods between the March Concept Outline and the October Draft LCFS Regulation.

March 2008 Concept Outline	October 2008 LCFS Draft Regulation
The carbon intensity of the diesel standard is adjusted by the vehicle drivetrain efficiency factor relative to a gasoline powered vehicle.	The carbon intensity of the diesel standard is *not* adjusted by the vehicle drivetrain efficiency factor.
Vehicle drivetrain efficiency factor used to account for greater efficiency of alternative fuel vehicles.	In addition to the vehicle drivetrain efficiency factor, a 'fuel displacement factor' or EER is used in the calculation of the amount of fuel delivered.
Credit or deficit is based the amount of fuel used by vehicles.	Credit is based on the amount of gasoline or diesel fuel that is displaced by use of the alternative fuel.
Credit generated is X	Credit generated is X*EER

Example calculation of comparison between the new and old calculations:

Electricity used as a diesel fuel replacement.

** ALL VALUES ARE USED FOR DISCUSSION ONLY AND MAY DIFFER FROM THOSE RELEASED IN TABLES 1, 2, AND 7 OF THE DRAFT LCFS REGULATION **.

EER=2.7
$UAFCI_{diesel}$ = 95.8 gCO2e/MJ (value determined from GREET)
$UAFCI_{electricity}$ = 106.7 gCO2e/MJ (value determined from GREET)
Total fuel supplied = 3600 MJ

Since this is an unblended fuel, using Eqn. A4.3,

$AFCI_{compliance}$ = 103/2.7

New credit calculation in Draft LCFS Regulation v2.0. (See example E1 in Appendix E for detailed explanation of the calculation)

$$NewCredits = [(95.8) - (106.7)(1/2.7)] \times 3600 \times 2.7 \times 1x10^{-6} = 0.55MT$$

The original credit calculation proposed in the March 08 Concept Outline

$$OriginalCredits = [(95.8) - (106.7)(1/2.7)](3600)(1x10^{-6}) = 0.20MT$$

NewCredits = 2.7**OriginalCredits*

APPENDIX E. Example Credit/Deficit Calculations

Example E1: Electricity General

An electricity Load Servicing Entity (LSE) is providing 1000 KWhr of electricity for transportation use. All of this electricity is used in heavy-duty applications (and hence, displaces conventional diesel fuel).

A comparison of an electric vehicle to a conventional diesel vehicle shows an EER of 2.7.

The unadjusted average fuel carbon intensity value of conventional diesel fuel is 95.8 gCO2e/MJ (Table 2); for electricity, it is 106.7 gCO2e/MJ. The energy density from Table 6 is 3.6 MJ/KWhr. Calculate the credit awarded to the LSE for providing the fuel electricity.

** All values are used for discussion only and may differ from those released in Tables 1, 2, and 7 in the Draft LCFS Regulation v2.0**.

The known values are:

$UAFCI_{diesel} = 95.8 gCO2e / MJ$

$UAFCI_{electricity} = 106.7 gCO2d / MJ$

$EnergyDensity = 3.6 MJ / KWhr$

$EER^{diesel}_{electricity} = 2.7$

The EER represents a factor that describes the amount of conventional diesel fuel energy that is displaced by the use of electricity for heavy-duty transportation application.

The amount of electricity provided as a diesel fuel replacement, in MJ, is

$$E^{diesel}_{actual} = 1000 * 3.6 = 3600 MJ$$

$$Credit^{diesel} = \begin{bmatrix} \text{Allowed GHG emissions generated from a} \\ \text{MJ of diesel that is displaced by the} \\ \text{use of electricity} \end{bmatrix} - \begin{bmatrix} \text{Actual emissions generated} \\ \text{by the use of electricity} \end{bmatrix}$$

In other words,

$$Credits^{diesel} = \left[(DisplacedEnergy)(UAFCI_{standard})\right] - \left[(ActualEnergy)(UAFCI_{electricity})\right]$$

Since $DisplacedEnergy = ActualEnergy \times EER$

$$Credits^{diesel} = \left(UAFCI_{standard} - UAFCI_{electricity} \times \frac{1}{EER^{diesel}_{electricity}} \right) \times \left(DisplacedDieselEnergy \right)$$

Notice that since electricity is an unblended fuel, the term $UAFCI_{electricity} \times \frac{1}{EER^{diesel}_{electricity}}$ is $AFCI^{diesel}_{compliance}$ in Eqn. A4.3.

$$Credits^{diesel} = \left(UAFCI_{standard} - AFCI^{diesel}_{compliance} \right) \times \left(DisplacedDieselEnergy \right)$$

$$= \left(UAFCI_{standard} - AFCI^{diesel}_{compliance} \right) \times E^{diesel}_{displaced}$$

$$= \left(UAFCI_{standard} - AFCI^{diesel}_{compliance} \right) \times \left(E^{diesel}_{electriciy} \times EER^{diesel}_{electriciyt} \right)$$

Numerically,

$$Credits^{diesel} = \left[(95.8) - (106.7)\left(\frac{1}{2.7} \right) \right](3600)(2.7)(1x10^{-6}) = 0.55MT$$

Since the fuel provider is only supplying electricity as a diesel fuel substitute

$Credits^{GEN} = Credits^{diesel}$

Example E2: Electricity PHEV

In 2020, the electricity LSE is providing 10 billion KWhr of electricity for transportation use. All of this electricity is used in light-duty applications (and hence, displaces conventional gasoline).

Assume the following values (used for discussion only):

$UAFCI_{gasoline} = 86.5 g / MJ$

$UAFCI_{electricity} = 106.7 g / MJ$

$EnergyDensityElectricity = 3.6 MJ / KWhr$

$EER_{electricity}^{gasoline} = 3.6$

** All values are used for discussion only and may differ from those released in Tables 1, 2, and 7 in the Draft LCFS Regulation v2.0**.

The credit awarded to the LSE is based only on the amount of electricity that is delivered to the vehicles. So for each case above, we need to determine the amount of electricity that is consumed when the vehicle is operating in electric mode.

The total energy supplied is

$$E = 1x10^{10}\ KWhr \times \left(3.6 \frac{MJ}{KWhr} \right) = 3.6x10^{10}\ MJ$$

$$Credits^{gasoline} = \left[(86.5) - (106.7)\left(\frac{1}{3.6} \right) \right] (3.6 \times 10^{10})(3.6)(1x10^{-6}) = 7.4 \times 10^{6}\ MT$$

Since this fuel provider is only supplying electricity as a gasoline substitute

$Credits^{GEN}$ **=** $Credits^{gasoline}$

Example E3: CA Reformulated Gasoline

A regulated party produces 80 million barrels of CARBOB in a quarter. The regulated party acquires 5 million barrels of corn ethanol and 4 million barrels of cellulosic ethanol to produce E10.

The carbon intensity and credits are calculated as follows:

Energy densities:
CARBOB: 119.53 MJ/gal
Ethanol: 80.53 MJ/gal

GREET carbon intensity values:
$UAFCI_{CARBOB}$: 95.2 gCO2e/MJ
$UAFCI_{ethanol}$ (dry mill, corn, no land use change): 75.6 gCO2e /MJ
$UAFCI_{ethanol}$ (cellulosic, CA switch grass, no land use change): 14 gCO2e /MJ

Unit conversions:
C=1x10^{-6} MT/gCO2e
42 gal/barrel

The EER for gasoline = 1.0

** All values are used for discussion only and may differ from those released in Tables 1, 2, and 7 in the Draft LCFS Regulation v2.0**.

1. Convert all volumes to energy units

   CARBOB: $\left(80x10^{6}\,barrels\right)\left(42\frac{gal}{barrel}\right)\left(119.53\frac{MJ}{gal}\right)=4.02x10^{11}\,MJ$

   Corn ethanol: $\left(5x10^{6}\,barrels\right)\left(42\frac{gal}{barrel}\right)\left(80.53\frac{MJ}{gal}\right)=1.69x10^{10}\,MJ$

   Cellulosic ethanol: $\left(4x10^{6}\,barrels\right)\left(42\frac{gal}{barrel}\right)\left(80.53\frac{MJ}{gal}\right)=1.35x10^{10}\,MJ$

2. Since E10 is a blended fuel, use Eqn. A4.1 to calculate the $AFCI^{\,gasoline}_{\,compliance}$

$$AFCI^{\,gasoline}_{\,compliance}(g/MJ)=\frac{(95.2)(4.02x10^{11})+(75.6)(1.69x10^{10})+(14)(1.35x10^{10})}{4.02x10^{11}(1.0)+1.35x10^{10}(1.0)+1.69x10^{10}(1.0)}=91.9$$

   Using Eqn. A4.2 to calculate $E^{\,gasoline}_{\,displaced}$

$$E^{\,gasoline}_{\,displaced}=4.02x10^{11}(1.0)+1.35x10^{10}(1.0)+1.69x10^{10}(1.0)$$

3. If the **gasoline standard is 92 gCO2e/MJ** for a given year, then the credits earned according to Eqn. A4 are:

$$Credits^{gasoline}(tons) = \left(UAFCI_{gasoline} - AFCI^{gasoline}_{compliance}\right)\left(E^{gasoline}_{displaced}\right)(C)$$

$$Credits^{gasoline} = (92 - 91.90)(4.02x10^{11} + 1.35x10^{10} + 1.69x10^{10})(1.0)(1x10^{-6}) = 4.32x10^{4}\,MT$$

For a gasoline provider, the total amount of credits generated is the same as the credits generated under the gasoline standard.

$$Credits^{GEN} = Credits^{gasoline}$$

Example E4: Provider of Multiple Fuels

A regulated party is providing E10 CaRFG, CNG, hydrogen and E85 in the amounts shown in the following table. All fuels are assumed to be gasoline replacements only. The carbon intensities of the fuels are also shown in the table below.

(All fuel quantities are assumed to have been converted to energy using appropriate energy densities in Table 6 of the Draft LCFS Regulation.)

Using the same gasoline standard of 92 gCO2e/MJ for a given year.

** All values are used for discussion only and may differ from those released in Tables 1, 2, and 7 in the Draft LCFS Regulation v2.0**.

Gasoline (E10) and E85*	E_i (MJ)	$UAFCI_i$ (g/MJ)	EER_i	E_i x $UAFCI_i$ (g)	$E_{displaced} = E_i \times EER_i$ (MJ)
CARBOB	1,021,000,000	95.2	1.0	97,199,200,000	1,021,000,000
Ethanol (corn)	122,000,000	75.6	1.0	9,223,200,000	122,000,000
Ethanol (cellulosic)	32,000,000	14	1.0	448,000,000	32,000,000
CNG					
CA CNG	70,000,000	69.3	1.0	4,851,000,000	70,000,000
non-CA CNG	30,000,000	75	1.0	2,250,000,000	30,000,000
Hydrogen					
H2, onsite SMR	50,000,000	102	2.2	5,100,000,000	110,000,000
Total	1,325,000,000			119,071,400,000	1,385,000,000

Step 1	**Determine the $ACFI_{compliance}$ for blended (or multiple) fuels using Eqn. A4.1.**	$AFCI_{compliance}$ (g/MJ)	85.97
Step 2	**Calculate credits/deficit generated using Eqn. A4 based on standard of 92 g/MJ**	$Credits^{gasoline}$ (MT)	8,348.60
Step 3	**Since all fuels are used as gasoline replacement**	$Credit^{GEN}$ (MT)	8,348.60

* Note. For gasoline and E85, since both the EER values are 1.0, the CARBOB and ethanols used to produced both fuels do not have to be separated. E_i values shown are total values used to produce both gasoline and E85.

Showing formulas:

	B	C	D	E	F	G
3	**Gasoline (E10) and E85***	E_i (MJ)	$UAFCI_i$ (g/MJ)	EER_i	E_i x $UAFCI_i$ (g)	$E_{displaced} = E_i \times EER_i$ (MJ)
4	CARBOB	1021000000	95.2	1.0	=C4*D4	=C4*E4
5	Ethanol (corn)	122000000	75.6	1.0	=C5*D5	=C5*E5
6	Ethanol (cellulosic)	32000000	14	1.0	=C6*D6	=C6*E6
7						
8	**CNG**					
9	CA CNG	70000000	69.3	1.0	=C9*D9	=C9*E9
10	non-CA CNG	30000000	75	1.0	=C10*D10	=C10*E10
11						
12	**Hydrogen**					
13	H2, onsite SMR	50000000	102	2.2	=C13*D13	=C13*E13
14	Total	=SUM(C4:C13)			=SUM(F4:F13)	=SUM(G4:G13)
15						
16	**Step 1**	**Determine the $ACFI_{compliance}$ for blended (or multiple) fuels using Eqn. A4.1.**			$AFCI_{compliance}$ (g/MJ)	=SUM(F4:F13)/SUM(G4:G13)
17						
18	**Step 2**	**Calculate credits/deficit generated using Eqn. A4 based on standard of 92 g/MJ**			$Credits^{gasoline}$ (MT)	=(92-G16) *SUM(G4:G13)*0.000001
19						
20	**Step 3**	**Since all fuels are used as gasoline replacement**			$Credit^{GEN}$ (MT)	=G18