Establishing New Fuel Pathways under the California Low Carbon Fuel Standard

Procedures and Guidelines for Regulated Parties and Fuel Providers

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I. Introduction

On April 23, 2009, the California Air Resources Board (ARB/Board) approved the California Low Carbon Fuel Standard (LCFS).[1] The LCFS establishes a compliance schedule that requires fuel providers to reduce the carbon intensity of the fuels they provide each year between 2011 and 2020. The 2020 carbon intensity level is ten percent below the baseline 2010 level. "Carbon intensity" is the total greenhouse gas emissions from the production, transport, storage, dispensing and use of a fuel. It is expressed as grams of carbon-dioxide-equivalent per megajoule of fuel energy (gCO_2e/MJ). In the context of the LCFS, the term "carbon intensity" refers to the full lifecycle greenhouse gas emissions associated with a specific fuel "pathway."

The LCFS requires fuel providers to determine the carbon intensity of the fuels they provide, and to report that information to ARB. This document describes the process providers are to use to determine fuel carbon intensity. ARB uses approved fuel carbon intensities to determine whether providers are in compliance with the regulation. Most transportation fuels sold in California are subject to the provisions of the LCFS.[2] Regulated parties must report the carbon intensities of the fuels they provide using a table of Board-approved carbon intensity values (a "lookup table") found in §95486(b)(1) of the LCFS Regulation. Some of the fuel carbon intensities in the lookup table were developed by ARB staff and approved by the Board. ARB developed this set of core pathways in order to facilitate the implementation of the LCFS: Implementation could have been substantially delayed if providers currently supplying fuel to the California market were required to obtain approval for their pathways before they could begin reporting under the regulation. Carbon intensities outside of the core set developed by staff, however, will primarily be the responsibility of fuel providers. The guidelines appearing in this document give fuel providers information they need to work effectively with staff to add additional fuel pathways to the LCFS lookup table(s).

II. Establishing New Fuel Pathways

Fuel providers may use one of two methods to determine the carbon intensities of the transportation fuels they provide to the California market. Under Method 1, fuel providers select carbon intensity values from the fuel carbon intensity lookup table found in §95486(b)(1) of the LCFS Regulation. Under Method 2, any entity, whether a regulated party or not, may seek Board or Executive Officer approval of additional fuel pathways or sub-pathways. If a proposed pathway or sub-pathway is approved, it is

[1] CCR Title 17, §95480, 95480.1, 95481, 95482, 95483, 95484, 95485, 95486, 95487, 95488, and 95489

[2] Certain very low-volume, non-biomass-based fuels, and fuels used in aircraft, racing vehicles, military vehicles, certain locomotives, and certain ocean-going vessels are exempt from the rule.

added to the lookup table, and becomes available to all fuel providers. The use of a new pathway or sub-pathway may begin as soon as it has been added to the lookup table.

Except in the case of fuels refined from high carbon intensity crude oils (HCICO—see Section VII, below), Method 2 is not available to providers of CARBOB, gasoline, and diesel. Section 95486(a) requires providers of non-HCICO CARBOB, gasoline and diesel to determine the carbon intensity of those fuels using only Method 1.

In general, fuel providers will use the following method to determine fuel pathway carbon intensities:

1. Estimate the direct lifecycle carbon intensity of the pathway. This may be done using the CA-GREET model (see Section II B, below), though use of the model at this point in the process is not required. In some cases, the fuel in question is produced using industry-standard processes that yield a known carbon intensity. Once the carbon intensity of the proposed fuel has been estimated, the applicant will consult the LCFS lookup table to determine whether it contains a valid reference pathway. A valid reference pathway is one that meets the following criteria:
    - The reference pathway from the lookup table describes essentially the same pathway the fuel provider uses. A corn ethanol pathway may not, for example, serve as a reference pathway for ethanol produced from corn stover. Because the pathway descriptions included in the lookup table are very brief, the fuel provide may need to consult the lifecycle analysis reports behind those pathways. These can be found at http://www.arb.ca.gov/fuels/lcfs/workgroups/workgroups.htm#pathways.
    - The lookup table carbon intensity is closer to the provider's carbon intensity value than any other candidate value, without being lower than the provider's value.
2. If a valid reference value is found in the lookup table, the provider may report that value to the ARB, subject to the approval of the Executive Officer. This would constitute a Method 1 report
3. If no valid reference value exists in the lookup table, the provider must apply to the Executive Officer for a new pathway under Method 2B.
4. If the provider locates a reportable reference value in the look-up table, but is not satisfied with that value, he or she may (if certain conditions are met) apply for a new sub-pathway value using Method 2A.

Under Method 2A, fuel providers may apply for the addition of new sub-pathways to the lookup table. A sub-pathway is a modified version of a pathway currently present in the table. New sub-pathways are added when a fuel provider can demonstrate that a new or improved fuel production, transport, storage, and/or dispensing process significantly reduces the lifecycle carbon intensity of an existing reference pathway. Method 2B

provides for the establishment of an entirely new fuel pathway. Such a pathway could yield an entirely new class of fuel, or it could describe an entirely new process for producing an existing fuel.

In some cases, a single facility would need to apply for more than one pathway. Two or more pathways are necessary for some facilities that are able to vary their production processes in ways that significantly affect the resulting fuel carbon intensity. Corn ethanol plants may, for example, be able to vary the feedstock used, to burn either natural gas, coal, or agricultural waste for process power, or to produce both wet and dry distillers' grains with solubles. Producers capable of varying one or more of these parameters would need to apply for a new pathway for each combination that is not already represented in the LCFS Lookup table. Once the new pathways were approved, the producer would need to maintain, for reporting purposes, production records sufficient to document all volumes produced using each pathway.

The purpose of this document is to provide fuel providers who wish to add new or modified pathways to the LCFS lookup table with the guidance they need to efficiently and effectively complete the application process. One of the stated goals of the LCFS is to incentivize the development of lower-carbon fuels for the California transportation market. As those fuels become available, their pathways must be added to the lookup table before they can begin earning credits for fuel providers. As such, ARB staff has designed the application process to be as streamlined as possible, while retaining the necessary scientific and technical rigor. Fuel providers who closely follow these procedures can expect the full and timely cooperation of ARB staff in processing and evaluating their applications.

A. Overview of the Method 2A and 2B Application Processes

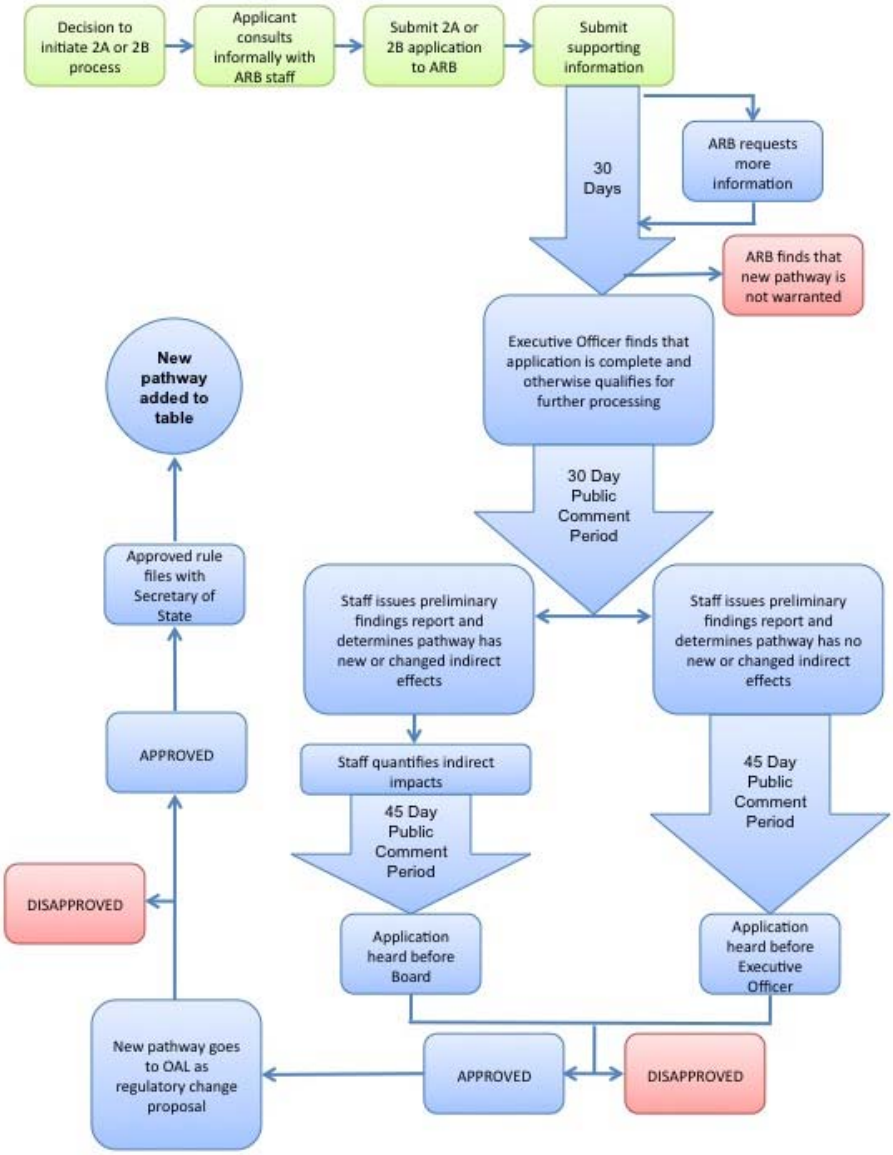
The LCFS fuel pathway lookup table is included in the LCFS regulation. The general process for revising or amending California regulations is as follows:

- Release the proposed changes to the public for a 45-day comment period;
- Conduct a public hearing to formally consider adoption of the proposed changes;
- If the proposed changes are approved by the rulemaking entity (the Board, in this case), they are forwarded to the Office of Administrative Law for consideration;
- Only after the Office of Administrative Law approves the proposed rules, and those rules are filed with the Secretary of State, do they become effective.

In the case of modifications to the LCFS lookup table, the Board has delegated certain authorities to the Executive Officer: So long as the proposed lookup table revisions do not involve new or revised indirect land use change emissions (or emissions from other indirect effects), the public hearing to consider those revisions may be held before the Executive Officer. Whenever a Method 2A or 2B application involves new or changed indirect effects, including land use change, the regulatory hearing must be conducted before the Board, as described in Section III, below.

A schematic of the application and approval processes is shown in Figure 1. The amount of time this process and each of its primary component parts take is shown in Figure 2.

Figure 1: Schematic of the Method 2A and 2B Application and Approval Process



B. Method 2A Application Procedures

Under Method 2A, fuel providers may apply for the establishment of a new fuel sub-pathway. A regulated party may apply for a new sub-pathway if it supplies, or intends to supply, a currently regulated fuel, but does so using a process that is similar—but not identical—to an existing approved pathway. A process improvement in which natural gas or coal requirements are significantly reduced by a conversion to

combined heat and power could, for example, produce enough of a carbon intensity reduction to warrant the establishment of new sub-pathway (a reduction of at least five gCO2e/MJ is required, as described below). A sub-pathway is created by incrementally modifying an existing pathway rather than by developing an entirely new pathway (which would be covered under Method 2B). A sub-pathway carbon intensity is created by recalculating the lifecycle carbon intensity of an existing fuel pathway. This is accomplished by revising one or more of the inputs to the models used to calculate fuel carbon intensity. The LCFS regulation requires the use of the California Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET) model to calculate "direct" pathway emissions (emissions generated by the production, transportation, storage, and dispensing of the fuel). Land use change impacts are evaluated using the Global Trade Analysis Project (GTAP) model (or an equivalent estimation method). Although applicants are required to calculate revised direct emissions using CA-GREET, the ARB is responsible for estimating land use change emissions, as described in section III, below.[3]

The presence of one or more existing pathways for a given fuel type doesn't guarantee that a reference pathway exists for a proposed new pathway for that fuel type. A reference pathway must share a common overall production process with the proposed pathway. Although the two pathways will diverge at one or more points in the production process, they cannot diverge so completely that they no longer utilize the same basic process. For example, as of mid-2010, the LCFS Lookup Table contained 13 corn ethanol pathways. Among them were two for wet mill plants that are at least partially coal-fired. The Table contained no pathways for coal-fired dry mill plants. An application for a dry mill, coal-fired ethanol pathway, therefore, would be a Method 2B application. The wet and dry mill production processes are too dissimilar for one process to be considered a sub-pathway of the other. In the absence of a reference pathway, a Method 2B application must be submitted.

Applicants estimate direct pathway emissions by revising CA-GREET input values to reflect revised fuel production, transport, storage, and/or dispensing processes. Proposed modifications can only be approved if they are supported by appropriate scientifically defensible documentation, and meet other criteria, as described below.

The two application processes are similar. The primary difference is that Method 2A applications are subject to "substantiality" requirements. These consist of minimum carbon intensity and fuel production thresholds. Method 2B applications are not subject to substantiality requirements.

The following discussion focuses primarily on the formal application, evaluation, and decision process. In order to expedite the application process, however, applicants are strongly urged to meet with ARB staff prior to initiating a Method 2A application. At a pre-application meeting, the prospective applicant can describe the proposed sub-

[3] Note that the direct lifecycle and land use change analyses overlap in the area of coproducts. The Method 2A/2B applicant is obligated to enter all relevant co-products data into CA-GREET. GTAP also uses information about co-products markets to calculate land use change credits.

pathway in detail to staff. The applicant may also submit preliminary documentation to staff for review. Staff, in turn, can begin to provide the applicant with a list of the specific types of information it will need in order to evaluate the applicant's proposal. Following the informal meeting, the applicant can continue to provide staff with additional information and to seek staff's guidance during the application development and evaluation processes.

(1) How to Apply

To apply for the establishment of a new sub-pathway, a fuel provider must:

- Fill out and submit a Method 2A application. The application form is available at http://www.arb.ca.gov/fuels/lcfs/. The completed form will serve as a cover sheet for the full application packet. The following information is required:
    - Identification and contact information: the applicant's name, affiliation (usually a fuel production or distribution firm), mailing address, e-mail address, phone number, and fax number. Three identification codes are also requested. Not all facilities will have all three codes; some will have none. Applicants are asked to supply all codes they do have. The requested identification codes are the LCFS Reporting Tool Organization ID code (which will be used to identify fuel providers in the LCFS reporting database), the U.S. EPA Company ID, and the U.S. EPA Facility ID.
    - The phone numbers and e-mail addresses of those who will be working with ARB on the development and evaluation of the proposed new sub-pathway. Contact information is requested for one person directly affiliated with the applicant, and for the applicant's consultant, if one has been retained.
    - The existing fuel pathway to which the proposed new sub-pathway would be most closely related. This reference pathway and the proposed new pathway must share a common overall production process. The proposed pathway will depart from the reference pathway at one or more points in the production process, but cannot depart so completely that a fundamentally different process is being defined. A reference pathway must also have a carbon intensity that is more than five grams of CO_2e/MJ higher than the proposed pathway (see the substantiality criteria discussion below).
    - The carbon intensity value that results from running CA-GREET using the revised inputs used in the applicant's lifecycle analysis.
    - A very brief statement of the key differences between the proposed pathway and the reference pathway.
    - The annual volume of fuel that would be produced using the proposed new sub-pathway.

- The energy content of the fuel that would be produced using the proposed new sub-pathway. The lower heating value, in units of megajoules per gallon, should be reported.
- Compositional differences, if any, between the fuel that will be produced using the proposed sub-pathway, and the fuel produced using the reference pathway. If compositional differences are identified, the GHG impacts of those differences (if any) must be described.
- The range of production volumes over which the proposed pathway carbon intensity value is valid. Energy-based, per-unit GHG emission levels will not always be constant over all production volumes. The sub-pathway application must specify the production volume range to which the proposed carbon intensity value applies. The application packet must contain documentation supporting this applicability range. Data and documentation submission requirements are described below.
- The applicant may optionally provide ARB with any information it feels may be relevant to the land use change analysis ARB will subsequently perform.

- The first document in an application packet should be a plain English summary of the proposed pathway. This summary will focus on the specific features of the proposed pathway most responsible for achieving carbon intensity reductions over the reference pathway. This will essentially be an expanded version of the statement in the application form itself concerning the differences between the proposed and reference pathways. It will describe how the proposed pathway meets the five gCO_2e/Mj substantiality requirement (which is described below).
- Submit a full lifecycle analysis report, along with all supporting documentation ARB will need in order to evaluate the proposed new sub-pathway. The information submitted will be used to determine whether the proposed sub pathway meets ARB's minimum requirements for substantiality and scientific defensibility. As such, it is only necessary to document those aspects of the proposed sub-pathway that are different from the reference pathway in the Lookup Table. It is not necessary to document pathway elements that are unchanged from the corresponding elements in the reference pathway. In general Method 2A lifecycle analyses should be similar in scope, level of detail, and organization to the lifecycle analyses done for the approved LCFS fuel pathways. These analyses are available at: http://www.arb.ca.gov/fuels/lcfs/workgroups/workgroups.htm#pathways.

  Electronic files should be submitted by e-mail or on CD/DVD. Applicants may also upload files to the ARB's FTP site. Please arrange FTP uploads with an ARB staff person. ARB requests that as many files as possible be submitted in electronic form. Spreadsheets and similar files that contain calculated values must be submitted with all formulas intact and accessible to ARB evaluators. The files submitted will be preserved in their original forms for reference purposes. ARB evaluators will use copies of the original submissions in the evaluation process. Applicants are asked to submit the following documentation,

at a minimum, in support of their lifecycle analyses. Any additional documentation that directly supports the proposed new sub-pathway should also be submitted.

- The official manufacturer's technical specifications of new equipment that contributes to the reported carbon intensity reductions.
- A table describing all fuel-consuming equipment. For each piece of equipment, include the following information
    i. Name and model number.
    ii. Function in the production process.
    iii. Type and quantity of fuel used.
    iv. Any other information relevant to the Method 2A Application.
- Technical drawings, schematics, flow diagrams, maps, and other graphical representations describing the proposed process changes.
- Technical papers reporting the results of pertinent greenhouse gas (GHG) emission studies. These could be articles from peer-reviewed journals, unpublished university or consulting reports, or studies that were prepared under contract to the applicant. If actual historical emissions data are not available, emissions projections are acceptable. If projections rather than empirical measurements submitted, they must be clearly identified as projections.
- Emissions monitoring data not otherwise submitted. This could be data from governmental regulatory entities, or data collected by entities testing or using the proposed equipment and processes.
- All applicable air quality operating permits issued by the local air pollution control Authority. If this permit contains a current, complete list of all combustion-powered equipment associated with the plant and all process fuels used by that equipment, no additional information about the combustion-powered equipment in the plant will be necessary. If the permit does not document all such equipment, a separate equipment list which corrects for all omissions and errors must be provided.
- Spreadsheets, data files, and similar files documenting the quantitative lifecycle analysis behind the carbon intensity value for the proposed new pathway. Unless it is impossible to do so, the applicant must submit files of this type electronically: by e-mail, on CD/DVD or via FTP (as described above). All such files must be submitted in a format that permits full and unimpeded access to all the data, formulas, and calculations they contain. In general, files of this type should be submitted in their native formats. CA-GREET files, in particular, must not be converted to any other format. If format conversions appear to be warranted in order to permit or improve access, the applicant must obtain ARB approval before proceeding with the proposed conversions.

- Any information the applicant feels would be relevant to the ARB's consideration of the land use change (or other indirect) impacts associated with the proposed sub-pathway. Providing this information is optional.

Once staff has received the applicant's full submittal package, it will evaluate that information to determine whether the package is complete and otherwise meets the basic criteria for the establishment of a new sub-pathway. A maximum of 30 days is allocated to this preliminary evaluation. In addition to completeness, staff will evaluate the submittal against the following criteria:

- Is the proposed sub-pathway sufficiently distinct from related pathways, or are the proposed process changes too few and/or too minor to constitute a new sub-pathway?
- Are the direct lifecycle emissions from the proposed sub-pathway based only on new direct lifecycle parameters that are subject to evaluation using the GREET model?
- Is the application likely to meet the Method 2A substantiality requirements (discussed below)?
- Is the application likely to meet the Method 2 scientific defensibility requirements (discussed below)?
- Is enough of the submitted material available for public review, or has too much of it been classified as trade secrets?

If the application packet is found to be incomplete, the applicant will be asked to submit the required information. If the application is found to clearly not meet one or more of the criteria listed above, it will be rejected, and the applicant will be provided with a document describing the basis of the rejection. This document will inform the applicant that rejected applications may be revised and resubmitted.

The purpose of this initial screening step is to identify those packets that are clearly deficient. If the deficiency is due only to missing information, the applicant is given the opportunity to provide that information so that processing can continue. Packets that do not meet one or more of the other criteria listed above should not be allowed to proceed through the Method 2A process. No packets that meet this very basic set of criteria will be rejected.

(2) Formal Evaluation

Following the initial screening step described in the previous section, Method 2A submittals will receive a more formal evaluation against the following criteria:

- *Substantiality*

- A new sub-pathway will only be approved if the applicant can demonstrate that the volume of fuel that will be produced using the proposed sub-pathway will rise to at least ten million gasoline-gallon-equivalents (gge) per year within about five years from the onset of production. Under some circumstances, such as the need to overcome technical challenges, a somewhat longer time horizon may be acceptable. Before using a time horizon greater than five years, however, the application should obtain written approval from the Executive Officer. At the applicant's discretion, the production volume analysis may consider all producers likely to use the proposed sub-pathway over the time horizon considered. If the applicant's firm can be shown to be reasonably likely to meet this requirement on its own, the inclusion of additional firms in the analysis is not necessary. For out-of-state producers, this 10 million gge minimum applies only to the product that would be coming into California. It would not apply to the total volume produced (unless every gge produced is to be sold in California). The factors that must be considered in the applicant's production projections are the following:
    i. Available feedstock supply
    ii. Production plant capacity
    iii. Fuel distribution and dispensing system and infrastructure
    iv. Supply of vehicles capable of utilizing the fuel produced under the proposed sub-pathway
    v. Economics: Considering all production, transportation, and dispensing costs (and any other relevant costs), will the resulting finished fuel be affordable to the end consumer and competitively priced relative to comparable fuels?
- The applicant must demonstrate that the proposed new sub-pathway will yield a carbon intensity improvement of at least five gCO_2e/MJ over the reference pathway. This carbon intensity improvement is calculated on a "well-to-tank" (or "source-to-tank") basis: All fuel lifecycle emissions except those resulting from the combustion of the fuel must be included.

- *Scientific Defensibility*
    - The minimum standard against which the Scientific Defensibility of a proposed new sub-pathway is measured is the robustness of the data and analysis on which the existing values in the lookup table are based. The LCFS regulation states, at §95486(e)(1)(A), that a new pathway is deemed to be scientifically defensible if the carbon intensity value it yields is at least as robust as the values currently in the lookup table. This robustness derives from the strength of the scientific and technical data behind those lookup table values.
    - The regulation provides an example of a method by which the scientific defensibility of a proposed new pathway can be demonstrated:

publication of an article describing that pathway in a major, well-established and peer-reviewed scientific journal such as *Science*, *Nature*, *Journal of the Air and Waste Management Association*, or the *Proceedings of the National Academies of Science* (§95486(e)(1)(B)). Applicants should note, however, that the Executive Officer will consider articles published in other journals, as well as unpublished reports, submitted by the applicant. Regardless of the source of the article or report, staff will consider the soundness of the data and the strength of the analysis in deciding the value of such sources in meeting the scientific defensibility criterion.

- If the applicant does not publish a description of the proposed new sub-pathway, as described above, staff will evaluate the scientific defensibility of that pathway by first verifying all information submitted by the applicant for authenticity. This will consist of checking the information submitted against original sources wherever this is possible (e.g., confirming the authenticity of manufacture's data). Once the authenticity of all submissions has been verified, those submissions will be evaluated to determine whether they adequately support the creation of the proposed new fuel sub-pathway. All calculations will be replicated and evaluated for appropriateness. When applications cover production processes with which ARB staff have had little or no experience, selected results will be sent to expert third-parties for evaluation.[4] Equipment manufacturers will be asked to confirm that the technical specifications submitted are current and still considered to be valid, etc. Because the burden of demonstrating scientific defensibility is on the applicant, issues that arise during the evaluation process will be referred to the applicant for resolution.
- In general, the applicant for a method 2A sub-pathway is only obligated to establish the scientific defensibility of the specific CA-GREET input parameters that will change under the proposed sub-pathway. In some cases, however, it may be necessary to establish a defensible basis for ***not*** changing additional CA-GREET inputs. If, for example, the proposed sub-pathway includes a new combined heat and power component, and no electricity is being generated and sold to the grid, it may not be clear why process energy inputs do not decrease.

- *Other*
  - Before the proposed new sub-pathway can be approved, the Executive Officer must find that the pathway is not already present in the lookup table.
  - Before the proposed new pathway can be approved, the Executive Officer must reach a determination that CA-GREET is capable of being modified to accurately calculate the carbon intensity of the proposed new pathway.

[4] The third parties to which applications would be referred would be ARB contractors.

If the Executive Officer cannot reach such a finding, the applicant will be required to use Method 1 to determine the carbon intensity of the fuel.

- The applicant must identify information it considers to be trade secrets in its Method 2A submittal. The pathway application and supporting documentation, except the information that the applicant identifies as consisting of trade secrets, are subject to public disclosure. The Executive Officer shall treat the trade secrets identified by the applicant in accordance with 17 CCR §§ 91000-91022[5] and the California Public Records Act (Government Code section 6250 et seq.). ARB will not attempt to determine whether information an applicant considers to be a trade secret truly qualifies for that designation. In deciding on what information to designate as secret, therefore, applicants must consider the public nature of the rulemaking process. New sub-pathways can be approved only if enough information is available publicly to justify that approval. ARB staff will determine on a case-by-case basis whether applications contain enough public information to be considered for approval under the State's public rulemaking process. Once a sub-pathway is approved and added to the lookup table, other fuel providers may use the new pathway to report their fuel carbon intensities if they can demonstrate that the new pathway best describes their processes. Such use by other fuel providers is unrestricted.
- The Executive Officer can request additional information, as needed, in the evaluation of the Method 2A application.
- Any use of carbon intensity values derived from a Method 2A application in any submittal to ARB—including quarterly and annual LCFS compliance reports—before the Board or the Executive Officer issues a written approval of the proposed new pathway constitutes a violation of the LCFS.

(3) Completeness and Consistency with Requirements

The Executive Officer has 30 calendar days to determine whether a Method 2A application is complete and consistent with basic application packet requirements. If the Executive Officer determines that an application meets these initial requirements, the applicant will be notified of this determination. If an application is deemed to be incomplete, the Executive Officer will notify the applicant in writing of that determination. That notification will identify the information that is missing from the application. Upon receipt of this notification, the applicant may submit the missing information. After receiving a re-submittal, the Executive Officer will, within 30 days, determine whether the additional information renders the application sufficiently complete to proceed to a full evaluation. If the Executive Officer again finds the application to be incomplete, the notification/re-submittal/re-evaluation process can repeated. Otherwise, the application will move to the full pathway evaluation phase of the process. If the application is found not to meet the basic requirements listed in Section (1) above, it will be rejected, and

[5] A copy of this regulation is available at http://www.arb.ca.gov/consprod/regact/2006surv/s34.pdf.

the applicant informed of the basis for this finding. Rejected applications may be revised and resubmitted as new applications.

Applications approved for a full pathway consideration are posted to ARB's LCFS website for public review. The public review period will last 45 calendar days.

(4) Preliminary Findings

Staff will evaluate the applicant's submittal package and prepare a set of preliminary findings. These findings will be released in the form of a preliminary staff report that will cover the following points, at a minimum.

- The extent to which the proposed CA-GREET input changes accurately describe the process that will actually be used to produce the affected fuel.
- The extent to which the direction and magnitude of the proposed CA-GREET input changes are reasonable and are adequately supported by the information submitted.
- The applicant's ability to meet the substantiality requirements described above.
- The likelihood that the proposed sub-pathway will create new or changed land use change or other indirect impacts.

Once it is approved internally, the preliminary findings document will be released to the applicant for comment. If a final draft acceptable to both staff and the applicant can be prepared, that draft will serve as Initial Statement of Reasons in the subsequent public hearing process (described in the following section). The preliminary findings document will contain staff's findings concerning the indirect impacts (if any) associated with the proposed sub-pathway. If staff finds that the sub-pathway will involve new or revised indirect impacts, those impacts will be quantified using the Global Trade Analysis Project (GTAP) or an equivalent model, and the results will be added to the final draft of the Initial Statement of Reasons. A finding that the proposed sub-pathway will entail new or revised indirect impacts will make it necessary for the public hearing to be held before the Board rather than the Executive Officer.

(5) Public Hearing and Subsequent Rulemaking Process

Regardless of whether a Method 2A application is heard before the Executive Officer or the Board, the formal rulemaking process established under the California Administrative Procedures Act must be followed before the LCFS lookup table can be modified. The steps in the rulemaking process are the following:

- ARB publishes a notice of proposed rulemaking in the California Regulatory Notice Register. The publication of this notice initiates a 45-day comment period on the addition of the proposed sub-pathway to the LCFS lookup table.

- At the end of the 45-day comment period, ARB convenes a public hearing to consider the proposed sub-pathway. If the Initial Statement of Reasons (discussed in the previous section) found that the proposed sub-pathway does not entail new or revised indirect impacts, the proposal will be heard before the Executive Officer. If the Initial Statement of reasons found that new or revised indirect impacts would be involved, the proposal will be heard before the Board.
- The public hearing culminates with a decision on the part of either the Executive Officer or the Board concerning the adoption of the proposed sub-pathway. The possible decisions are approve, disapprove, and approve subject to specified revisions. The applicant will be notified of the outcome in writing, and the results will be posted to the LCFS web site. If an application is not approved, the letter informing the applicant of that finding will describe the basis of the disapproval.
- If approval comes with a requirement for substantive revisions to the sub-pathway proposal, staff and the applicant must complete the required revisions, and initiate a 15-day comment period on those changes. A public hearing is not required following a 15-day comment period, but one may be held in some cases. ARB is obligated to fully consider all comments received during the comment period in deciding on the proposed revisions.
- ARB must respond to all comments received during the original 45-day comment period, and any subsequent comment periods. Those responses are compiled into a document known as a Final Statement of Reasons.
- The Final Statement of Reasons, and other pertinent rulemaking documents, are submitted to the California Office of Administrative law, which is the body responsible for rendering a final decision on all proposed California regulations.
- Within 30 days the Office of Administrative Law must either approve the proposed rule and forward it to the Secretary of State for publication, or disapprove the proposal and return it to the ARB for correction.
- If the Office of Administrative Law rejects a proposed sub-pathway, ARB has 120 days to correct the problems that triggered the rejection. A 15-day comment period is automatically initiated in this case.

A schematic of the application and approval processes is shown in Figure 1. As shown in Figure 2, the application process typically takes about six months. More than one Method 2 application can move through the system at the same time. Two or more applications may be heard at the same hearing.

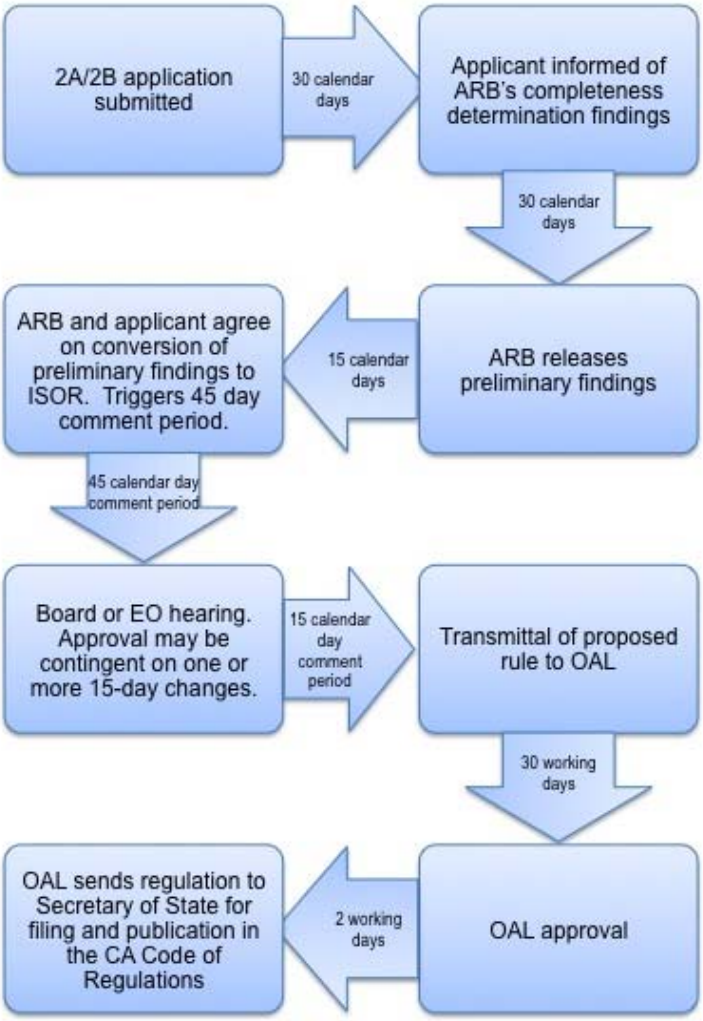


Figure 2: Total Application Time Investment (typically about 6 months)

C. Method 2B Application Procedures

Under Method 2B, fuel providers may apply to the Executive Officer for the establishment of an entirely new fuel pathway. New pathways are not modifications of existing pathways, as are Method 2A sub-pathways. Pathways approved under Method 2B constitute entirely distinct pathways. In some cases, they become the first pathways in a new family of sub-pathways. In others, they will reside in an existing family of sub-pathways (such as the corn ethanol family), but will not be closely related to any of the other pathways in that family. An example of a pathway in this second category is described in Section II b, above. Like Method 2A sub-pathways, Method 2B pathways are created using the ARB's carbon intensity determination tools: CA-GREET and GTAP (or an equivalent model).

A new pathway would be needed if an entirely new fuel formulation were brought to market, or if an entirely new process were used to produce an existing fuel. No pathway currently exists for biodiesel from algae, for example. Before algal biodiesel can be marketed in California, therefore, a supplier of that fuel will need to apply for a new pathway using Method 2B.

A significant difference between the Method 2A and 2B application processes is that no substantiality requirements (minimum carbon intensity change or production volume levels) apply to Method 2B applications.

The following discussion focuses primarily on the formal Method 2B application, evaluation, and decision process. In order to expedite the application process, however, applicants are strongly urged to meet with ARB staff prior to initiating a Method 2B application. At a pre-application meeting, the prospective applicant can describe the proposed pathway in detail to staff. The applicant may also submit available preliminary documentation to staff for review. Staff, in turn, can begin to provide the applicant with a list of the specific types of information it will need in order to evaluate the applicant's proposal. Following the informal meeting, the applicant can continue to provide staff with additional information and to seek staff's guidance during the application development process.

A schematic of the application and approval processes is shown in Figure 1. The amount of the time the process and each of its component parts take is shown in Figure 2.

(1) How to Apply

The Method 2B application process is similar to the Method 2A process. Applicants must:

- Fill out and submit a Method 2B application. The application form is available at http://www.arb.ca.gov/fuels/lcfs/. The completed form will serve as a cover sheet for the full application packet. The following information is required:
    - Identification and contact information: the applicant's name, affiliation (usually a fuel production or distribution firm), mailing address, e-mail address, phone number, and fax number. Three identification codes are also requested. Not all facilities will have all three codes; some will have none. Applicants are asked to supply all codes they do have. The requested identification codes are the LCFS Reporting Tool Organization ID code (which will be used to identify fuel providers in the LCFS reporting database), the U.S. EPA Company ID, and the U.S. EPA Facility ID.
    - The phone numbers and e-mail addresses of those who will be working with ARB on the development and evaluation of the proposed new pathway. Contact information is requested for one person directly

affiliated with the applicant, and for the applicant's consultant, if one has been retained.

- A very brief description of the proposed fuel, emphasizing the distinctive or innovative qualities of the finished fuel and/or the production process.
- The carbon intensity of the fuel that would be produced using the proposed pathway, as estimated by CA-GREET.
- The energy content of the fuel that would be produced using the proposed pathway. The lower heating value, in units of megajoules per gallon, should be reported.
- The range of production volumes over which the proposed pathway carbon intensity value is valid. Energy-based, per-unit GHG emission levels will not always be constant over all production volumes. The pathway application must specify the production volume range to which the proposed carbon intensity value applies. The applicant must submit documentation supporting this applicability range. Data and documentation submission requirements are described below.
- The applicant may optionally provide ARB with any information it feels may be relevant to the land use change analysis ARB will subsequently perform.

- The first document in an application packet should be a plain English summary of the proposed pathway. This summary will focus on the innovative or unique features of the proposed pathway.
- Submit a full lifecycle analysis report, along with all supporting documentation ARB will need in order to evaluate the proposed new pathway. The information submitted will be use to determine whether the proposed pathway meets the ARB's minimum requirements for scientific defensibility. In general, Method 2B lifecycle analyses should be similar in scope, level of detail, and organization to the lifecycle analyses done for the approved LCFS fuel pathways. These analyses are available at:

  http://www.arb.ca.gov/fuels/lcfs/workgroups/workgroups.htm#pathways.

  Electronic files should be submitted by e-mail or on CD/DVD. Applicants may also upload files to the ARB's FTP site. Please arrange FTP uploads with an ARB staff person. ARB requests that as many files as possible be submitted in electronic form. All spreadsheets and similar files that contain calculated values must be submitted with all formulas intact and accessible to ARB evaluators. The files submitted will be preserved in their original forms for reference purposes. ARB evaluators will use copies of the original submissions in the evaluation process. Applicants are asked to submit the following documentation, at a minimum. Any additional documentation that directly supports the proposed new sub-pathway should also be submitted.

  - The official manufacturer's technical specifications of new equipment that contributes to the GHG reductions from the proposed new pathway.

- A table describing all fuel-consuming equipment. For each piece of equipment, include the following information
    i. Name and model number.
    ii. Function in the production process.
    iii. Type and quantity of fuel used.
    iv. Any other information relevant to the Method 2A Application.
- Technical drawings, schematics, flow diagrams, maps, and other graphical representations describing the proposed process change.
- Technical papers reporting the results of pertinent greenhouse gas (GHG) emission studies. These could be articles from peer-reviewed journals, unpublished university or consulting reports, or studies that were prepared under contract to the applicant. If actual historical emissions data are not available, emissions projections are acceptable. If projections rather than empirical measurements submitted, they must be clearly identified as projections
- Emissions monitoring data not otherwise submitted. This could be data from governmental regulatory entities, or data collected by entities testing or using the proposed equipment and processes.
- All applicable air quality operating permits issued by the local air pollution control authority. If this permit contains a current, complete list of all combustion-powered equipment associated with the plant and all process fuels used by that equipment, no additional information about the combustion-powered equipment in the plant will be necessary. If the permit does not document all such equipment, a separate equipment list which corrects for all omissions and errors must be provided.
- Spreadsheets, data files, and similar files documenting the quantitative lifecycle analysis behind the carbon intensity value for the proposed new pathway. Unless it is impossible to do so, the applicant must submit files of this type electronically: by e-mail, on CD/DVD or via FTP (as described above). All such files must be submitted in a format that permits full and unimpeded access to all the data, formulas, and calculations they contain. In general, files of this type should be submitted in their native formats. CA-GREET files, in particular, must not be converted to any other format. If format conversions appear to be warranted in order to permit or improve access, the applicant must obtain ARB approval before proceeding with the proposed conversions.
- Any information the applicant feels would be relevant to the ARB's consideration of the land use change (or other indirect) impacts associated with the proposed new pathway. Providing this information is optional.

Once staff has received the applicant's full submittal package, it will evaluate that information to determine whether the package is complete and otherwise meets the basic criteria for the establishment of a new pathway. A maximum of 30 days is allocated to this preliminary evaluation. In addition to completeness, staff will evaluate the submittal against the following criteria:

- Is the proposed new pathway sufficiently distinct from other pathways, or is the proposed process merely a variant of one or more processes used in other pathways?
- Are the direct lifecycle emissions from the proposed sub-pathway based only on new direct lifecycle parameters that are subject to evaluation using the GREET model?
- Is the application likely to meet the Method 2 scientific defensibility requirements (discussed below)?
- Is enough of the submitted material available for public review, or has too much of it been classified as trade secrets?

If the application packet is found to be incomplete, the applicant will be asked to submit the required information. If the application is found to clearly not meet one or more of the criteria listed above, it will be rejected, and the applicant will be provided with a document describing the basis of the rejection. This document will inform the applicant that rejected applications may be revised and resubmitted.

The purpose of this initial screening step is to identify those packets that are clearly deficient. If the deficiency is due only to missing information, the applicant is given the opportunity to provide that information so that processing can continue. Packets that do not meet one or more of the other criteria listed above should not be allowed to proceed through the Method 2B process. No packets that meet this very basic set of criteria will be rejected.

(2) Formal Evaluation

Following the initial screening step described in the previous section, Method 2B submittals will receive a more formal evaluation against the following criteria. Unlike Method 2A applications, Method 2B submittals are not subject to substantiality requirements.

- *Scientific Defensibility:*
    - The minimum standard against which the Scientific Defensibility of a proposed new sub-pathway is measured is the robustness of the data and analysis on which the existing values in the lookup table are based. The LCFS regulation states, at §95486(e)(1)(A), that a new pathway is deemed to be scientifically defensible if the carbon intensity value it yields is at least as robust as the values currently in the lookup table. This

robustness derives from the strength of the scientific and technical data behind the lookup table values.

- The regulation provides an example of a method by which the scientific defensibility of a proposed new pathway can be demonstrated: publication of an article describing that pathway in a major, well-established and peer-reviewed scientific journal such as *Science*, *Nature*, *Journal of the Air and Waste Management Association*, or the *Proceedings of the National Academies of Science* (§95486(e)(1)(B)). Applicants should note, however, that the Executive Officer will consider articles published in other journals, as well as unpublished reports, submitted by the applicant. Regardless of the source of the article or report, staff will consider the soundness of the data and the strength of the analysis in deciding the value of such sources in meeting the scientific defensibility criterion.
- If the applicant does not publish a description of the proposed new pathway, as described above, staff will evaluate the scientific defensibility of a proposed new pathway by, first, verifying all information submitted by the applicant for authenticity. This will consist of checking the information submitted against original sources wherever this is possible (e.g., confirming the authenticity of manufacture's data). Once the authenticity of all submissions has been verified, those submissions will be evaluated to determine whether they adequately support the creation of the proposed new fuel pathway. All calculations will be replicated and evaluated for appropriateness. When applications cover production processes with which ARB staff have had little or no experience, selected results will be sent to expert third-parties for evaluation.[6] Equipment manufacturers will be asked to confirm that the technical specifications submitted are current and still considered to be valid, etc. Because the burden of demonstrating the scientific defensibility is on the applicant, issues that arise during the evaluation process will be referred to the applicant for resolution.
- In order for the Board or the Executive Officer to approve the proposed new pathway, staff must reach a finding that the proposed CA-GREET input changes accurately describe the process that will actually be used to produce the affected fuels, and that the direction and magnitude of the proposed input changes are reasonable and adequately supported by the information submitted. That finding, if reached, will be documented, and a copy of the document provided to the applicant.

- *Other*
  - Before the proposed new pathway can be approved, the Executive Officer must find that the pathway is not already present in the lookup table.

[6] The third parties to which applications would be referred would be ARB contractors.

- Before the proposed new pathway can be approved, the Executive Officer must reach a determination that CA-GREET is capable of being modified to accurately calculate the carbon intensity of the proposed new pathway. If the Executive Officer cannot reach such a finding, the applicant will be required to use either Method 1 or Method 2A to determine the carbon intensity of the fuel.
- The applicant must identify information it considers to be trade secrets in its Method 2B submittal. The pathway application and supporting documentation, except the information that the applicant identifies as consisting of trade secrets, are subject to public disclosure. The Executive Officer shall treat the trade secrets identified by the applicant in accordance with 17 CCR §§ 91000-91022[7] and the California Public Records Act (Government Code section 6250 et seq.). ARB will not attempt to determine whether information an applicant considers to be a trade secret truly qualifies for that designation. In deciding on what information to designate as secret, therefore, applicants must consider the public nature of the rulemaking process. New sub-pathways can be approved only if enough information is available publicly to justify that approval. Once a sub-pathway is approved and added to the lookup table, other fuel providers may use the new pathway to report their fuel carbon intensities if they can demonstrate that the new pathway best describes their processes. Such use by other fuel providers is unrestricted.
- The Executive Officer can request additional information, as needed, during the evaluation of the Method 2B application.
- Any use of carbon intensity values derived from a Method 2B application in any submittal to ARB—including quarterly and annual LCFS compliance reports—before the Board or the Executive Officer issues a formal written approval of the proposed new pathway constitutes a violation of the LCFS.
- Unlike Method 2A applications, Method 2B applications are not subject to substantiality requirements.

(3) Completeness and Consistency with Requirements

The Executive Officer has 30 calendar days to determine whether a Method 2B application is complete and consistent with basic application packet requirements. If the Executive Officer determines that an application meets these initial requirements, the applicant will be notified of this determination. If an application is deemed to be incomplete, the Executive Officer will notify the applicant in writing of that determination. That notification will identify the information that is missing from the application. Upon receipt of this notification, the applicant may submit the missing information. After receiving a re-submittal, the Executive Officer will, within 30 days, determine whether

[7] A copy of this regulation is available at http://www.arb.ca.gov/consprod/regact/2006surv/s34.pdf.

the additional information renders the application sufficiently complete to proceed to a full evaluation. If the Executive Officer again finds the application to be incomplete, the notification/re-submittal/re-evaluation process can repeated. Otherwise, the application will move to the full pathway evaluation phase of the process. If the application is found not to meet the basic requirements listed in Section (1) above, it will be rejected, and the applicant informed of the basis for this finding. Rejected applications may be revised and resubmitted as new applications.

Applications approved for a full pathway consideration are posted to ARB's LCFS website for public review. The public review period will last 45 calendar days.

(4) Preliminary Findings

Staff will evaluate the applicant's submittal package and prepare a set of preliminary findings. These findings will be released in the form of a preliminary staff report that will cover the following points, at a minimum.

- The extent to which the proposed CA-GREET input changes accurately describe the process that will actually be used to produce the affected fuel
- The extent to which the direction and magnitude of the proposed CA-GREET input changes are reasonable and are adequately supported by the information submitted.
- The likelihood that the proposed pathway will create land use change or other indirect impacts.

Once it is approved internally, the preliminary findings document will be released to the applicant for comment. If a final draft acceptable to both staff and the applicant can be prepared, that draft will serve as Initial Statement of Reasons in the subsequent public hearing process (described in the following section). The preliminary findings document will contain staff's findings concerning the indirect impacts (if any) associated with the proposed new pathway. If staff finds that the proposed pathway will involve indirect impacts, those impacts will be quantified using the GTAP or an equivalent model, and the results will be added to the final draft of the Initial Statement of Reasons. A finding that the proposed pathway will entail indirect impacts will make it necessary for the public hearing to be held before the Board rather than the Executive Officer.

(5) Public Hearing and Subsequent Rulemaking Process

Regardless of whether a Method 2B application is heard before the Executive Officer or the Board, the formal rulemaking process established under the California Administrative Procedures Act must be followed before the LCFS lookup table can be modified. The steps in the rulemaking process are the following:

- ARB publishes a notice of proposed rulemaking in the California Regulatory Notice Register. The publication of this notice initiates a 45-day comment period on the addition of the proposed pathway to the LCFS lookup table.
- At the end of the 45-day comment period, ARB convenes a public hearing to consider the proposed pathway. If the Initial Statement of Reasons (discussed in the previous section) found that the proposed pathway does not entail indirect impacts, the proposal will be heard before the Executive Officer. If the Initial Statement of reasons found that indirect impacts would be involved, the proposal will be heard before the Board.
- The public hearing culminates with a decision on the part of either the Executive Officer or the Board concerning the adoption of the proposed pathway. The possible decisions are approve, disapprove, and approve subject to specified revisions. The applicant will be notified of the outcome in writing, and the results will be posted to the LCFS web site. If an application is not approved, the letter informing the applicant of that finding will describe the basis of the disapproval
- If approval comes with a requirement for substantive revisions to the pathway proposal, staff and the applicant must complete the required revisions, and initiate a 15-day comment period on those changes. A public hearing is not required following a 15-day comment period, but one may be held in some cases. ARB is obligated to fully consider all comments received during the comment period in deciding on the proposed revisions.
- ARB must respond to all comments received during the original 45-day comment period, and any subsequent comment periods. Those responses are compiled into a document known as a Final Statement of Reasons.
- The Final Statement of Reasons, and other pertinent rulemaking documents, are submitted to the California Office of Administrative law, which is the body responsible for rendering a final decision on all proposed California regulations.
- Within 30 business days the Office of Administrative Law must either approve the proposed rule and forward it to the Secretary of State for publication, or disapprove the proposal and return it to ARB for correction.
- If the Office of Administrative Law rejects a proposed pathway, ARB has 120 calendar days to correct the problems that triggered the rejection. A 15-day comment period is automatically initiated in this case.

A schematic of the application and approval processes is shown in Figure 1. The amount of time this process and each of its primary component parts take is shown in Figure 2. More than one Method 2 application can move through the system at the same time. Two or more applications may be heard at the same hearing.

III. Determination of Land Use Change Effects and Other Indirect Effects

Applicants for new pathways and sub-pathways may optionally provide ARB with any information they feel may be relevant to the land use change analysis ARB will subsequently perform. The following considerations are important to both the applicant and to ARB in assessing the likelihood of land use change or other indirect impacts:

- Existing indirect effect values (including the zero, or "no effect," value) will not be changed to reflect insignificant differences.
- Table 1, below, identifies fuels that ARB has deemed to have negligible or no land use change impacts. In the absence of information to the contrary, the applicant may assume that pathways for the fuels listed in Table 1 entail no significant land use change impacts.
- ARB staff will determine whether land use change or other indirect impacts are likely.
- Although staff will consider all information submitted by the applicant, staff's findings are not constrained by that information. If staff determines that significant new or changed land use change impacts are likely, the formal Board Hearing process will be initiated.
- If staff finds that a proposed Method 2A sub-pathway is likely to generate land use change impacts that are essentially the same as those generated by the reference pathway, the proposed sub-pathway will not subject to a land use change evaluation.
- At the direction of the Executive Officer, ARB staff will perform all formal land use change impact evaluations. When staff's preliminary assessment indicates that land use change impacts are likely, the magnitude of those impacts will be estimated using the Global Trade Analysis Project (GTAP) model (or an equivalent model). Once approved, land use change estimates can only be modified by subsequent Board action.

Some Method 2 applications will be filed primarily for the purpose of changing or establishing a land use change (or other indirect) carbon intensity value. A producer of corn ethanol may be able to demonstrate, for example, that the use of fractionation results in a significant reduction in land use change impacts over traditional ethanol-production pathways. When corn is fractionated into its primary components, the resulting starch can be processed into ethanol. The other components can then be utilized in ways that could reduce the land use change impacts of corn ethanol production more than do the co-products associated with current production methods. The reduced land use change emissions of such a pathway could be more important to producers than any changes in the direct lifecycle impacts.

In order for sub-pathways that include reduced land use change impacts to be approved by the Board, however, the impact reductions must be reasonably permanent and readily verifiable. Process modifications that can be easily reversed will not be

approved. Examples of processes the Board would not consider to be permanent and verifiable include small-scale and easily reversible changes to agricultural practices, such as the adoption of no-till methods, and the use of lower carbon fuels such as biodiesel in truck fleets capable of running on either biodiesel or petroleum diesel. When changes such as these are adopted on a regional (e.g., multi-state) scale, however, the Board will consider approving pathways that include them.

When approving pathways and sub-pathways that include improvements that reduce land use change impacts, the Board may impose conditions to aid staff in monitoring the fuel suppliers who use those pathways. They may, for example, require the periodic submission of documents confirming that the claimed improvements are still in place and fully functional.

IV. Fuels Deemed to Have Negligible or No Land Use Change or Other Indirect Effects

On April 23, 2009, the Board approved staff's proposed Low Carbon Fuel Standard, but directed staff to prepare several revisions to that rule, and to take various other actions relative to rule implementation. Among the actions staff was directed to take was the creation of an informal set of "criteria and a list of specific biofuel feedstocks that are expected to have no or inherently negligible land use effects on carbon intensity" (Air Resources Board Resolution 09-31, April 23, 2009, p. 15). The overriding condition that must be met before a fuel can be included on this list is that production of its feedstock must not compete with the production of food, feed, or fiber crops. A recent paper published in *Science* (Tillman et al., 2009) also recommends this approach. It places the fuels that meet this criterion into five basic categories:

- Fuel feedstock crops grown on abandoned farmland that is currently degraded. Not only would crops grown in this way not compete with food crops, they could also prove to be environmentally beneficial. They could potentially improve wildlife habitat and water quality, and increase carbon sequestration.
- Fuels produced from crop residues. Although crop residues increase soil fertility, decrease erosion, and improve soil carbon stores when left on fields, some residues can be removed without compromising these benefits. The removable fraction is capable of supporting the production of significant quantities of biofuels.
- Sustainably harvested wood and forest residues. These include the slash that is currently left in place after timber harvesting, residues from milling and pulp production, thinnings from fire prevention operations, as well as wastes from management operations undertaken to reduce competition and hasten the growth of marketable trees. In approving the LCFS, the Board directed the Executive Officer to work with stakeholders to define the terms "biomass" and "renewable biomass." As part of that effort, the Executive Officer is to assess the effects of incentivizing the use of forest biomass as a fuel feedstock, as well as the protections that would be necessary to ensure the sustainable and environmentally beneficial use of forest biomass. The goal of this effort would be

to approve pathways for fuels produced from forest biomass, should the use of this feedstock be found to be sustainable and environmentally beneficial.

- Double and mixed cropping. Biofuel crops that can be grown and harvested between existing cropping rotation phases (and which do not interfere with those rotations) do not displace food, feed, or fiber crops. An example would be a winter biofuel feedstock grown on land that would otherwise remain fallow during the winter season. Crops that can be grown along with other crops (such as between food crop rows) would also avoid the displacement of food, feed, and fiber crops.
- Municipal and industrial waste streams. Waste streams that include paper products, yard waste, construction wastes, and plastics are viable sources of feedstocks that do not entail land use change impacts.

Table 1 contains both fuels that meet these criteria, as well as other fuels that staff has found to entail no significant land use change effects. Additional fuels may be added to this table when and if staff determines that their land use change impacts are, at most, negligible. The list of candidate fuels currently under consideration are the following:

- Petroleum-based fuels, and fuels produced using petroleum-based process energy, including:
    - Fossil CNG and LNG;
    - Electricity from petroleum-powered generation facilities;
    - Hydrogen produced in petroleum-powered facilities
- Nuclear power, as well as fuels produced using nuclear power (i.e., hydrodgen)
- Hydroelectric power, as well as fuels produced using hydroelectric power.
- Hydrogen produced using petroleum or electricity generated using petroleum for process power

Fuel providers wishing to apply for new pathways or sub-pathways for the fuels in this table can state on their Method 2A and 2B applications that those pathways should entail no significant land use change impacts. Applicants should cite Table 1 by way of support for such a statement.

Producers considering the use of Method 2B to establish a pathway involving one of the feedstocks appearing in Table 1 should be aware that—although the fuels appearing in the Table will incur, at most, a very small land use change charge—they may be found to incur other categories of carbon intensity charges. One such charge would occur if the feedstock used for fuel production is diverted from another use. The quantity that is diverted from the competing use would have to be at least partially replaced with a substitute raw material. The acquisition of that substitute raw material may generate GHG emissions that would be charged to the fuel. The possibility also exists that indirect effects other than land use change could be identified in connection with a new fuel feedstock.

Table 1: Fuels Expected to Have No or Inherently Negligible Land Use Effects on Carbon Intensity

Fuel	Feedstock	Conditions/Restrictions
Any Fuel	Any category of biomass waste except forest waste. Primarily municipal solid waste (including demolition waste). Forest waste appears elsewhere in this table.	
Any Fuel	Double cropped, winter cropped or mixed cropped feedstocks	Feedstock crops that are added to an existing rotation without in any way affected that rotation. The lack of an impact on the existing rotation must be thoroughly documented (though, e.g., long-term planting and harvesting records).
Biodiesel	Used cooking oil	
	Inedible Tallow (sourced in the United States)	
	Medical Waste	
	Algae	Specific conditions of operation must be known in order to assess land use impacts if any; it may be necessary to demonstrate sustainable production of algae without displacement of crop land..
Renewable Diesel (RD)	Inedible Tallow (sourced in the United States)	
Fischer–Tropsch Diesel	Forest Waste (gasification)	Criteria Under Development
	Agricultural Waste (gasification)	No impacts if enough residues are left on fields to ensure soil and crop health (only sustainable quantities are utilized for fuel).[a] Requires verification.
	Medical Waste (gasification)	
	Dedicated crops such as Poplar (gasification) (see "Forest Waste" and "Dedicated Crops" under "Cellulosic Ethanol," below)	
	LFG and Digester Gas	

Fuel	Feedstock	Conditions/Restrictions
Cellulosic Ethanol	Forest Waste	Criteria Under Development
	Agricultural Waste (stover from corn, straw from rice and wheat; vineyard prunings)	No impacts if enough residues are left on fields to ensure soil and crop health (only sustainable quantities are utilized for fuel).[a] Requires verification.
	Switchgrass	If grown on land unsuitable for crops, impacts are zero. Also, if grown between traditional crop growing periods, Land Use Change impacts should be zero. Verification will be required.
	Industrial Waste	
	Lumberyard mill residues	
	Dedicated crops (such as Poplar) grown on land unsuitable for food crop cultivation	Needs verification that land is unsuitable for food crop cultivation.
CNG/LNG	Landfill Gas	
	Sewage Digester Gas	
	Dairy Digester Gas	
Electricity	Solar Generation	
	Wind Generation	
	Biomass-Fueled Generation	The biomass fuel used must have been found to have no land use change impacts.
	Sewage-Digester-Gas-Fueled Generation	
	Landfill-Gas-Fueled Generation	
	Dairy-Digester-Gas-Fueled Generation	
Hydrogen	LFG	Process power must be from one of the sources listed in this table
	Dairy Digester Gas	
	Sewage Digester Gas	
	Electrolysis	

[a] Enough crop residue must be left on the field to insure the maintenance of sufficient soil organic matter. Depletion of organic matter is ultimately not sustainable, eventually leading to the need for additional crop land to replace the lost production.

V. Priority Pathways for Inclusion in the Lookup Table

Table 2 lists the fuel pathways which staff has designated as having a high priority for addition to the Lookup Table during 2010. Fuel providers not need to apply for approval of these pathways under Methods 2A and 2B.

Staff continues to develop pathways for fuels with the potential to benefit California. Most such fuels would utilize feedstocks and other resources available in-State, and are likely to create jobs for Californians. Staff will also give precedence to fuels which are most likely to be available in significant quantities during the first few years of the LCFS implementation. Fuels which may not be available in significant quantities early on, but which could contribute to overall fuel carbon intensity reductions over the longer term are also given priority. Among this group of fuels are those that are likely to be developed with the assistance of the Alternative and Renewable Fuel and Vehicle Technology Program (AB 118). Under this program, the Energy Commission is authorized to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. The Energy Commission has an annual program budget of approximately $100 million to support such projects.

Table 2: Priority Pathways for Inclusion in the Lookup Table

Fuel	Feedstock	Source of Priority Status
Biodiesel	Canola*	Likely importance of canola biodiesel in contributing to the supply low-carbon diesel substitute fuels.
Biodiesel	Corn Oil*	Likely high prevalence of corn oil extraction; need to properly allocate the resulting credits from added production efficiency and reduced need for biodiesel from other feedstocks.
Biodiesel	Used Cooking Oil from the Midwest*	This pathway can be easily developed through simple modification of the California used cooking oil pathway. There was no need to require producers to apply for this pathway.
Ethanol	Sorghum	Likely importance of sorghum-based ethanol: Although sorghum ethanol cannot be produced in the same quantities as corn ethanol, it could play an important role as a low-carbon gasoline substitute.

*All biodiesel pathways in this table share one source of priority status: the importance to providers of diesel fuels (and to the LCFS) of securing an adequate low-carbon diesel supply.

VI. Future Certification Program.

In its approval of the Low Carbon Fuel Standard, the Board directed the Executive Officer to work with stakeholders to develop “robust, transparent, and specific

criteria for conducting Carbon Intensity Lookup Table modifications through a certification process" (Resolution 09-31, April 23, 2009, page 18). The most effective approach to designing a certification process is to base that process upon the experience gained working with regulated parties to develop new pathways and sub-pathways. As the Executive Officer and staff gain experience assisting applicants, evaluating applications, responding to comments, and holding hearings, they will be applying that experience on an ongoing basis to the development of a pathway certification process proposal. Such a process would be similar to the existing ARB fuel additive certification process: Proposed additives are subjected to a set of standardized evaluations that are comprehensively described in a certification procedures manual. In order to develop an LCFS fuel pathway certification process, staff will consciously work to systematize and standardize the application evaluation process. The result will be an increasingly streamlined, efficient, and clearly defined process—one that can be readily transformed into a certification process.

When a pathway certification process proposal has been drafted, staff will seek Board approval to formally integrate that process into the LCFS regulation. If approved, that process will replace the one described herein.

VII. Evaluation of High Carbon Intensity Crude Oils.

The purpose of this section is to clarify how a regulated party determines the appropriate carbon intensity values for CARBOB and diesel fuel derived from crude oil sources that are part of the "2006 California baseline crude mix," as defined in the next section.

Definitions

- "Included in the 2006 California baseline crude mix" means the crude oil constituted at least 2.0 percent of the 2006 California baseline crude mix, by volume, as shown by California Energy Commission records for 2006.
- "High carbon intensity crude oil" means any crude oil that has a total production and transport carbon intensity value greater than 15.00 gCO_2e/MJ.

Regulation requirements

Section 95486(b)(2)(A) of the LCFS regulation specifies the requirements for using the Lookup Table to determine carbon intensity values for CARBOB, gasoline, and diesel fuel. This section requires a regulated party to use the average carbon intensity value shown in the Lookup Table if the fuel is derived from crude oil that is either 1) "included in the 2006 California baseline crude mix" or 2) not a "high carbon intensity crude oil". If neither of these conditions apply, the regulated party must either use 1) the carbon intensity shown in the Lookup Table corresponding to the crude oil's pathway or 2) the carbon intensity determined via Method 2B if there is no carbon intensity shown in the Lookup Table corresponding to the crude's pathway.

If Method 2B shows that the carbon intensity for crude oil production and transport is less than or equal to 15 gCO_2e/MJ, the finished fuel will be assigned the average carbon intensity value from the Lookup Table for CARBOB, gasoline, or diesel fuel. Technologies such as carbon capture and sequestration may be used by a producer to reduce the carbon intensity for crude oil production and transport to less than 15 gCO_2e/MJ. If Method 2B shows that the carbon intensity value for crude oil production and transport is greater than 15 gCO_2e/MJ, the finished fuel will be assigned the total carbon intensity value determined by Method 2B.

Implementation:
The regulation language implies that ARB should promulgate a means of determining which crude oil sources will result in the finished fuel being assigned the average carbon intensity value from the Lookup Table.

A. Crude oils which are "included in the 2006 California baseline crude oil mix"
   Table 3 shows that at least two percent of the total California crude oil in 2006 was received from the following sources: California, Alaska, Saudi Arabia, Ecuador, Iraq, Brazil, Mexico, and Angola. Finished fuels derived from these sources will be assigned the average carbon intensity value from the lookup table. The Board has directed ARB staff to conduct comprehensive program reviews in both 2011 and 2014. The crude oils considered as part of the California baseline mix and the potential change in the carbon intensity of crudes included in the California baseline mix would necessarily be evaluated during these and subsequent program reviews and addressed via regulatory change if deemed necessary.

Table 3: Breakdown of Crude Supplied to California Refineries in 2006[8]

Source of Crude	Percentage of Total CA Crude
California	38.83
Alaska	16.12
Saudi Arabia	13.27
Ecuador	10.86
Iraq	8.57
Brazil	2.74
Mexico	2.36
Angola	2.29
Columbia	1.43
Oman	0.97
Venezuela	0.63
Argentina	0.53
All others	1.42

B. Crude oils which are not "included in the 2006 California baseline crude oil mix"
A workgroup consisting of industry, environmental, governmental, and academic stakeholders has been established to assist in developing a screening process that will be used to determine the appropriate carbon intensity to be assigned to crude oil sources that are not "included in the 2006 California baseline crude oil mix." A two step screening process has been proposed:

1. Clearly non-HCICO production: Crude oil production methods and reservoir characteristics will be evaluated using non-HCICO identifiers, a set of conservative considerations designed to quickly identify clearly non-HCICO sources. Fuels derived from crude sources satisfying all of the identifiers will be assigned the average carbon intensity value from the Lookup Table. An example of potential identifiers follows:
   - Crude oil produced by means other than enhanced oil recovery or crude bitumen mining.
   - Gas flaring: A maximum rate for gas flaring during crude production will be established using input from the workgroup.
   - An indicator for low intensity primary/secondary recovery such as field depth, field depth and water-to-oil ratio, or field depth and field age.
2. For crude oil sources not meeting all of these identifiers, regulated parties will be required to submit a more rigorous carbon intensity assessment according to the Method 2B process to determine if the crude oil meets the 15 gCO_2/MJ threshold.

[8] California Energy Commission (2009). "Energy Almanac" Retrieved from http://energyalmanac.ca.gov/petroleum/statistics.

VI. References

Tilman, David, Robert Socolow, Jonathon A. Foley, Jason Hill, Eric Larson, Lee Lynd, Stephen Pacala, John Reilly, Tim Searchinger, Chris Somerville, and Robert Williams. "Beneficial Biofuels—The Food, Energy, and Environment Trilemma." *Science* 325:270-271. July 17, 2009.