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ADVANCES IN LIFECYCLE ASSESSMENT OUTLINE

The purpose of this outline is to inform Panelists of staff's initial findings and analysis related to the topic below. Staff proposes to use this and similar outlines to develop the white papers/chapters of the review report due to the Board in December 2011. Please review this outline and identify where data are insufficient and what data are necessary to meet the requirements of the regulation review. This outline is meant to be a high-level overview of the topic; more detail will follow in subsequent white paper/chapter.

V. Advances in Lifecycle Assessment

- A. Introduction
- B. Direct Lifecycle Assessment
 - 1. Background (pathways approved in 2009)
 - a. ARB staff used CA-GREET 1.8b to develop the direct-CI portion of an initial set of 64 fuel pathways. (GTAP was used to estimate the indirect CIs, as described below). These consisted of:
 - i. 37 pathways for gasoline (CARBOB) and gasoline substitutes, and
 - ii. 27 pathways for diesel and diesel substitutes.
 - b. The Lookup Tables holding these original pathways were included in the LCFS regulation.
 - i. This necessitated a full regulation change (staff report, comment period, hearing, final statement of reasons) every time we add a new pathway. The purpose of this approach was to build transparency into the pathway approval process.
 - ii. Board Resolution 09-31 directed the Executive Officer to develop a certification program through which fuel pathways would be approved once the evaluation/approval process had matured.
 - iii. In the absence of a certification program, the existing pathway approval process would continue to be lengthy and laborious. We have received a number of comments asking us for an expedited procedure.
 - 2. Staff developed the initial set of fuel pathways. Beginning in early 2010, biofuel producers began to submit fuel-pathway applications through the Method 2A/2B process. Concurrently, staff began developing new fuel pathways for inclusion in the Lookup Tables.
 - a. The direct CIs continue to be estimated with CA GREET 1.8b.
 - b. To expedite the Method 2A/2B approval process, Board Resolution 10-49 directed the Executive Officer to develop a

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procedure whereby applicants could begin using their pathway CIs before they receive full regulatory approval.

- i. Regulatory Advisory 10-04 spelled out the conditions under which new pathways could be used prior to final approval.
 - ii. Use could begin once staff recommended a pathway for approval and posted it to the Method 2A/2B web site.
 - iii. To date, staff has posted 112 new pathways onto the Method 2A 2B web site.
- c. The Executive Officer conducted a public hearing on February 24, 2011, to consider six 2A/2B applications covering 25 fuel pathways and two staff-derived fuel pathways (used cooking oil and corn oil biodiesel).
- i. These pathways were remanded to staff for refinement during a 15-day change period.
 - ii. Refinements are nearing completion, and the rulemaking is expected to be completed within about two months.
3. New Method 2A/2B applications continue to be submitted, and development of new staff-derived fuel pathways is underway. One of the first of these fuel pathways will cover the conversion of food and related organic wastes into biogas via anaerobic digestion.
4. Moving from a regulatory process to a certification process is one of the proposed LCFS regulation revisions being developed by staff for Board consideration in December. Staff will maintain a public review and comment process within the proposed certification procedure. The Board directed staff, in Resolution 09-31 to implement such a transition if it is found to be feasible.
5. ARB is in the final stages of awarding a contract to a firm that will refine CA-GREET 1.8b to make it easier to use, and increase its overall utility and transparency. The contractor will also help staff become conversant with the latest advances in the area of lifecycle analysis.

C. Lifecycle Assessment – Indirect Effects

1. Summary of “Original” Indirect Effects Modeling for the LCFS
 - a. Land use change (LUC) modeling for biofuels
 - i. Choice of model
 - ii. Model structure, inputs and assumptions
 - iii. Emission factors
 - iv. Time accounting

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- b. Indirect effects for fuels other than biofuels
- 2. Advances in indirect effects modeling
 - a. Revisions to the GTAP model
 - i. July, 2010 report from Purdue University
 - ii. Recent model changes
 - b. LCFS Expert Workgroup
 - i. Background
 - ii. Summary of key findings and recommendations
 - c. Summary of academic and European Commission studies
- 3. Present status and future work on indirect effects modeling
 - a. LUC modeling
 - i. Contracts
 - ii. Short-term revisions to LUC carbon intensity values
 - iii. LUC values for additional pathways
 - iv. Long-term issues for research
 - b. Modeling of indirect effects for fuels other than biofuels
 - i. Contracts
 - ii. Intentions for future work
- D. Summary and Conclusions