Low Carbon Fuel Standard Life Cycle Analysis (LCA) Working Group 1 Meeting

October 4, 2007

California Environmental Protection Agency

Air Resources Board

Agenda

- Introductions
- LCA Group Objective
- Issues to be considered
- Discussion of issues
- Stakeholder presentations
- Other items to be discussed
- Topic of focus for next meeting
- Proposed meeting date(s)

LCFS Schedule

2007	University of California completes LCFS study with CEC & ARB
2007-2008	Conduct LCFS workshops
Early 2008	Initiate draft regulatory language
Fall 2008	Regulatory package completed
End of 2008	LCFS regulation submitted to the Board for consideration
2009	Regulation submitted to Office of Administrative Law
2010-2020	Implementation

Life Cycle Analysis

- Objective of Full Life Cycle Analysis

  - To ensure that all fuels are compared from a “well-to-wheels” pathway

  - Committed to this since January 2007 following Executive Order S-1-07

  - Include all stakeholders and participants in the development process

  - Learn from prior and current LCAs world-wide consistent with our requirements

  - Improve and append analysis every few years

Life Cycle Analysis Capable Models

- GREET (Argonne)
- LEM (Mark Delucchi – UC Davis)
- GaBi (PE International)
- GHGenius (NRC Canada)

LCA Models Comparison

Models	Description	Limitations
GREET	• Identified emissions from transportation sector for U. S., with limited land use impact factors • Criteria pollutant and GHGs addressed for multiple pathways •Widely used model by various studies • Stochastic simulation available	• Limited land use factors and sustainability not addressed. • National averages and does not allow resource mix • Limited CA specific factors. • No economic/price effects • Impact of toxics not available.
LEM	•More comprehensive data source than GREET with improved accounting for land use, vehicles, etc. • Allows for evaluating impacts of resource mix (such as crude from various sources). • CO_2 equivalency factors are different from IPCC values. Includes HFCs, and CFCs • Climate impacts of CO, NOx, PM, SOx included • Results applied for variety of fuels, time frames, and countries.	• Not available in public domain and hence limited scope as a regulatory tool. • Has model specific global warming potentials and deviates from IPCC values. • No economic/price effects except for some quasi-elastic treatment. • Impact of toxics not available.

LCA Models Comparison

Models	Description	Limitations
GaBi	• Capable of retrieving inputs from various databases. This allows the model to work in different areas of interest (biofuels, construction, etc.) • Scenario analysis available	• Proprietary and cost to license
GHGenius	• Canadianized version of Mark Delucchi's LEM model •GHG and criteria emissions for LD and HD only • More comprehensive criteria emissions than the LEM • Economic assessment of the cost of GHG reductions • Sensitivity tool and Monte Carlo simulation available	• Does not include all types of vehicles (mini-buses, scooters, etc.) • Probably similar limitations as the LEM model

LCA Model Selection

- GREET from Argonne Lab

  - Energy Commission used a modified GREET model for their Alternative Fuels Plan

  - U. S. EPA is adopting the use of GREET with appropriate modifications for their Renewable Fuels Program and Low Carbon Fuel Standard

LCA Model Selection

- Propose to use GREET with necessary modifications to calculate pathway GHG for regulation rule making process
- Recognize issues associated with GREET model:
  - Co-products
  - Land Use
  - Sustainability
  - Uncertainty
  - Default Values
  - Fuel Pathways

Issues

- Co-product credit issues
  - Energy, value or mass based credit used in various studies
  - Need for consistent basis to allocate credit

Issues

- Land Use Issues
  - Inclusion of nitrogen impacts (from fertilizer, manure, crop rotation, residue use, etc.)
  - Agricultural run-off
  - Waste-water treatment
  - Variability and uncertainty in agricultural inputs
  - Land cover change (albedo, evapotranspiration, dust from farming, etc.)
  - Agriculture for food

Issues

- Sustainability Issues
  - Water use for biofuel production
  - Ecosystem impact
  - Forest replacement with agricultural land
  - Others

Issues

- Uncertainty and Sensitivity
  - Input values to models are highly variable depending on source, particularly from agriculture
  - Output impacts are at times highly sensitive to certain inputs
  - Some inputs do not have measurable values at the present time
  - Uncertainty in values particularly when a single resource is an average from various areas

Issues

- Default values and baseline
  - Methodology to define and calculate ‘default’
  - What about for non-measurable parameters?
  - Establish baseline year for assessing future benefits

Issues

- Fuel Pathways to be considered initially
  - RFG and ULSD via different crude and refinery specifics applied to CA
  - Ethanol via various pathways (some such as sugarcane not in GREET and electricity mix in GREET is national average)
  - Biodiesel from various feedstocks and pathways (land use issues not covered in detail in GREET)
  - Renewable diesel (not available in GREET)
  - Electricity from different generation sources
  - Hydrogen from biomass (CA specific biomass not available)
  - Other fuels

Next Meeting Topic

- Focus for next meeting of WG1
- Work to be accomplished before next meeting

Next Meeting Date

- Next meeting date: early November
- Future meetings

For More Information

- Contact us:

  Anil Prabhu, Ph.D.
  (916) 327-1501; aprabhu@arb.ca.gov
  Chan Pham
  (916) 323-1069 ; cpham@arb.ca.gov

- Visit our website at:

  http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

Open for Discussion