Background on the CRC LCA Workshops

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Overview

- A Little History…
  - > Legislative/regulatory drivers for the use of life cycle analysis (LCA) to assess greenhouse gas (GHG) emissions from transportation fuels
  - > Important and thought-provoking research around transportation fuel LCA issues appearing in late-2000s
- 2009 Workshop – Getting our feet wet, focus on biofuels
- 2011 Workshop – The science is advancing, but uncertainties remain
- 2013 Workshop – What we hope to accomplish
- Moving Forward

Legislative/Regulatory Drivers

…California Low Carbon Fuel Standard

- Gov Schwarzenegger signs EO S-01-07 (Jan 2007) calling for a 10% reduction in carbon intensity of transportation fuels by 2020 measured on a "full fuels cycle basis."
- University of California called upon to provide technical and policy analyses (reports published August 2007)
  - > Under the LCFS, fuel providers required to track the global warming intensity (GWI) of their products and reduce this value over time
  - > "Life cycle" refers to all of the activities included in production, transport, storage and use of fuel
  - > *"Land use change effects should be included in the LCFS, though cautiously at first, with the understanding that further research may change our understanding of this issue and therefore how it should be regulated."*
- CARB tasked with developing LCFS as an early action measure pursuant to AB 32 (rulemaking activities began in fall 2007; regulation adopted Apr 2009; implemented 2010 ~ CI reductions required 2011)

Legislative/Regulatory Drivers

…U.S. Renewable Fuel Standard

- President Bush signs the Energy Independence and Security Act into law in December 2007
- Title II of EISA established volume and GHG reduction targets for renewable fuels
  - > *"'Lifecycle greenhouse gas emissions' means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes)…related to the full fuel lifecycle."*
  - > GHG estimates to include all stages of fuel and feedstock production and distribution
  - > Mass values for GHGs adjusted to account for their relative global warming potential
- EPA tasked with developing regulations implementing biofuel mandates established in EISA (NPRM released May 2009; final rule February 2010)

Legislative/Regulatory Drivers

…E.U. Renewable Energy Directive

- Directive 2009/28/EC (Energy from Renewable Sources, adopted April 2009)
  - > 10% target for renewable energy in transport by 2020
- Directive 2009/30/EC (Fuel Quality Directive, adopted April 2009)
  - > 10% GHG reduction by fuel suppliers (6% through alternative fuels)
  - > Regulations on biofuel blends for gasoline and diesel (e.g., E10 and B7)
  - > Called for a report on indirect land use change
- GHG calculations to consider:
  - > extraction/cultivation of raw materials
  - > carbon stock changes caused by land use change
  - > emissions from processing/transport/distribution/use of fuel
  - > emissions savings from soil carbon accumulation via improved AG mgmt
  - > emissions savings from carbon capture and geological storage
  - > emissions savings from carbon capture and replacement
  - > emissions savings from excess electricity from cogeneration

Research Around LCA Issues

...Studies appeared with increasing frequency in late-2000s timeframe

- Crutzen, P.J. et al, "N_2O Release from Agro-Biofuel Production Negates Global Warming Reduction by Replacing Fossil Fuels." Atmos. Chem. Phys. Discuss., 7, August 1, 2007.
- Righelato, R. and D. Spracklen, "Carbon Mitigation by Biofuels or by Saving and Restoring Forests?" Science, vol. 317, August 2007.
- Brandt, A.R. and A.E. Farrell, "Scraping the Bottom of the Barrel: CO2 Emission Consequences of a Transition to Low-Quality and Synthetic Petroleum Resources." Climatic Change, 84(3-4), October 2007.
- Searchinger, T. et al, "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change," Science, vol. 319, February 2008.
- Fargione, J. et al, "Land Clearing and the Biofuel Carbon Debt," Science, vol. 319, February 2008.
- Many responses to the above work, especially the Searchinger and Fargione papers…

Large Variability Across Different LCA Efforts

- Different tools and assumptions led to dramatically different results, particularly for land use change estimates.
- Understanding these differences was the primary motivation for initiating the CRC LCA workshops.

CRC LCA Workshop Goals

…Have not changed much among the three workshops

Goals for 2009/2011/2013:

- Outline technical needs arising out of policy actions and ability of LCA efforts to meet those needs
- Identify data gaps, areas of uncertainties, validation/verification, model transparency, and data quality issues
- Establish priorities for directed research to narrow knowledge gaps and gather experts' opinions on where scarce research dollars would best be spent

Additional Goal for 2011/2013:

- Identify research results and activities that have come to light in the past two years that have helped to close data gaps previously outlined as outstanding issues

2009 CRC LCA Workshop

…Getting our feet wet; focus on biofuels

- **Workshop Sessions**

  > Regulatory framework and regulatory needs
  > LCA modeling overview
  > Growing of feedstock & soil/fertilizer interaction
  > Land use change and GHG emissions
  > Biofuel processing and co-product credits

- **Key Take-Aways**

  > Uncertainties associated with LUC are significant; more research critically needed
  > More research needed to better quantify N2O emissions
  > Transparency of LCA models and model inputs is important
  > Thought should be given to standardization of modeling protocol, especially around treatment of co-products
  > Consensus that actively preserving and managing forests are very important ways to reduce global GHG emissions

2011 CRC LCA Workshop

...The science is advancing, but uncertainties remain

- **Workshop Sessions**
  - > Current regulatory environment – lessons learned; what's next
  - > LCA gaps and uncertainties
  - > LUC and GHG emissions – panel discussion on major models
  - > LUC and GHG emissions – new data/approaches & estimation questions
  - > Emerging LCA issues
  - > Open forum discussion

- **Key Take-Aways**
  - > Considerable work accomplished between 2009 and 2011 to improve LUC and LCA models; despite improvements, uncertainty issues remain
  - > Concept of iLUC is very complex; no broad consensus on how to assess iLUC effects of biofuels or baseline, reference fuels
  - > N_2O and co-product accounting continue to be challenging
  - > Consensus remains: actively preserving and managing forests are very important ways to reduce global GHG emissions

2013 CRC LCA Workshop

...What we hope to accomplish

- **Workshop Sessions**

  > Regulatory environment/new policies driving LCA pathways/methodologies
  > LCA methodology development, gaps and uncertainties
  > Advances in LCA of biofuels
  > Advances in LCA of petroleum/alternatives
  > Open forum discussion

- **Additional Goals**

  > We have built in considerable time for discussion; please make use of that
  > Identify areas of consensus and areas of disagreement – any way to close those gaps?
  > Where do we go from here…
    - Are these workshops useful?
    - Is there a defined product or end-point that we could steer towards?
    - Are there issues we are missing?

Thank You