



Session 5

Biofuel Processing and Co-product Credits

Session Objectives

- What are the proper methods and key elements in determining carbon intensity for individual biorefineries? What information is needed to reduce uncertainty and enhance the verification of LCA for different production options? What are the key uncertainties and how can they be reduced? What are the appropriate research priorities?
- What are the limitations of current co-product LCA methods, and how can uncertainties and verification issues be better addressed? How should co-products be treated in the context of market transitions expected in the future? What are the appropriate research priorities?

Chairpersons:

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Biofuel Production and Co-product Technology Highlights and Learnings

Key Points

- Important opportunities for water management process improvements
- Growing experience with 7 feedstocks on 3 different continents
- Evolution from conventional corn ethanol to advanced platforms to convert glucose and xylose to alkane pathways



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Highlights and Learnings

Key Parameters in LCA

- Yield
- Irrigation
- Nitrogen Fertilizer
- Residue Removal Rate
- Biogenic Carbon Content

**Draft Results suggest E85 achieves 19% GHG ↓
compared to 2005 Baseline Gasoline**

**Somewhat troubling is that 4 of 5 assessed cases
where “Baseline” assumptions ended up as “Outliers”**



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Highlights and Learnings

Base ethanol plants have improved

40,000 → 32,000 → 29,000 Btu/gal

1.4 → 0.75 → 0.69 kWh/gal

Emerging opportunities

- Bran conversion to cellulosic ethanol ↑ 4-10%
- CHP application / optimization ↑ 18%
- Corn oil extraction (cost of 10% electricity) ↑ 3-4%
- Anaerobic Digester Biogas save 21,000 Btu/gal HHV

Downside risk for scenarios is fertilizer contribution to Nitrogen and Global Warming Impact of 11-24 gCO₂/MJ



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Highlights and Learnings

90% of corn-ethanol biorefineries are currently natural gas powered dry mills producing distillers grains for livestock feed.

Co-product GHG credits can represent 10 to 40% of total life cycle GHG emissions

Regional variability in corn production GHG-intensity is also relevant for corn substitutions in the CP credit (e.g. larger credit in Texas)

Co-product markets can get saturated



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Highlights and Learnings

By 2015, with 15 Billion gallon of Corn Ethanol, approximately 37 Million Metric Tons of Distillers Grains will be produced

Beef and Dairy are major consumers, all WDGS consumed by beef and dairy cattle (35 mln ton DGS supply is feasible)...displace soy

Displacement method: Most conservative LCA method

- Data intensive: need detailed understanding of the displaced product sector**
 - Dynamic results: subject to change based on economic and market modifications**
- Results developed using this method will need to be revised regularly**

Energy Allocation method

- Easy to use**
 - Frequent updates not required for mature industry, e.g. Petroleum refineries**
- Results not entirely appropriate, when coproducts are used in non-fuel applications**

Lower GHG emissions are possible



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Gaps Identified

Follow ISO guidelines whenever possible

System expansion if possible, then allocation

Average operations vs. marginal changes (attributional vs. consequential), consider which is most appropriate and if data exists

Modern tillage and crop/land management practices can significantly improve sustainability of biofuels

Biorefinery process design has a large impact environmental metrics

Utility systems have a huge impact on overall net energy and GHG

Many environmental uncertainties remain

Data Needs for Types and Characteristics of co-products;

livestocks being fed; Inclusion level; hauling distances; co-product exported; Differentiated N₂O emissions and emission



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Gaps Identified

Need for regular surveys (annual/biennial) conducted by Independent organization reporting

* yield of Corn Ethanol and Coproducts, energy consumption

* coproducts use by animal type, inclusion levels, animal performance

Feedback/Survey of Professional Animal Industry Nutritionists regarding typical animal diets with or without Coproducts

Heating values of new coproducts (HPDDG, Corn germ, de-oiled DDGS)

Displacement ratio scenarios to calculate Coproduct credit for individual biorefineries

Reconcile Distillers Grains Displacement Ratios with GTAP/CARB approach