

Comments on California-Modified GREET pathway for Corn Oil Biodiesel

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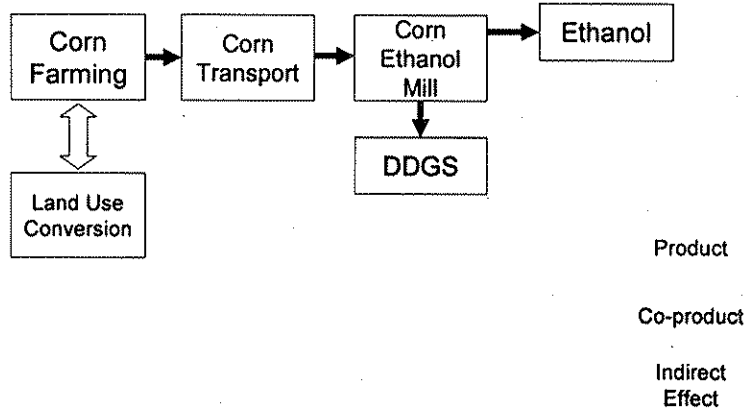
Life Cycle Associates, LLC

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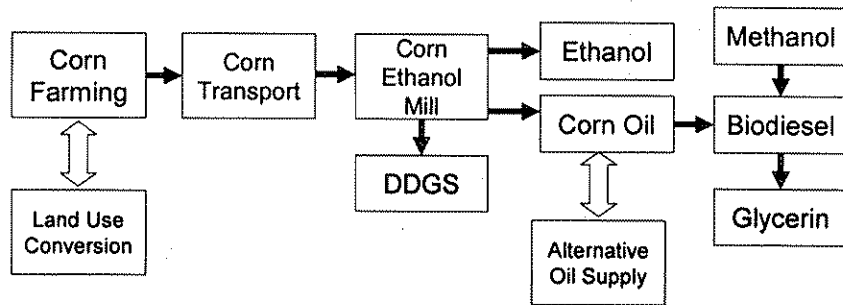
Corn Oil Biodiesel Pathway

- Treating corn oil extraction technology as an incremental technology is inconsistent with standards for life cycle assessment and other fuel pathways analyzed by ARB
- Corn oil biodiesel (COB) promotes the conversion of feed to fuel and should be reflected in the life cycle analysis.

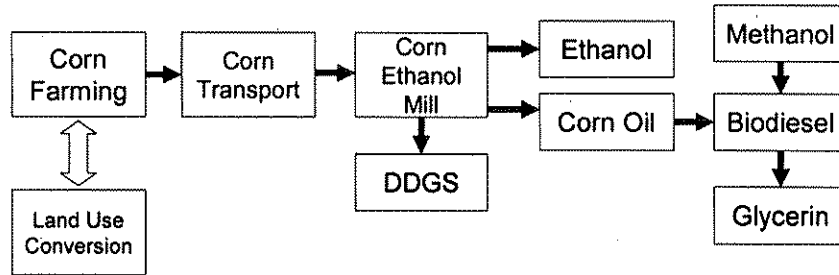
Corn Ethanol System Boundary



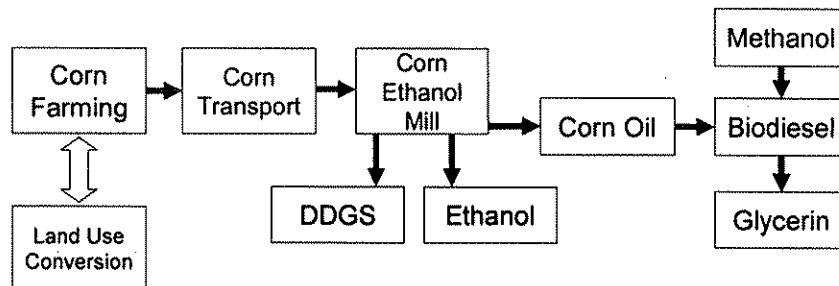
Corn Oil Biodiesel – System Boundary for Consequential LCA



Corn Oil Biodiesel - System Boundary for Energy Allocation



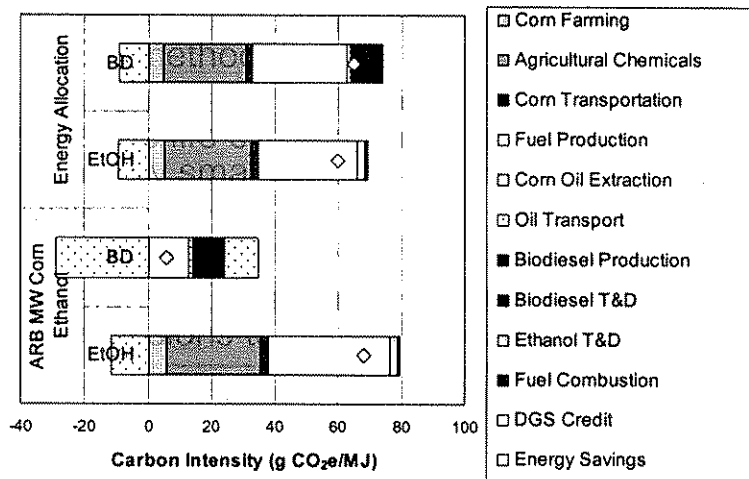
Corn Oil Biodiesel - System Boundary for ARB Approach



Issues with ARB Approach

- Corn oil component is valuable fraction of DDGS converting feed to fuel
- COB is a co-product with first order consequential LCA already addressed in GREET methodology
- Incremental approach creates a “golden gallon” where the life cycle impacts are concentrated into a very small amount of fuel
- ARB’s incremental COB approach proves a preferential incentive for one technology
- Therefore, LCA should distribute energy inputs and emissions to both ethanol and COB

Comparison of LCA Results



Emissions per bushel are about the same with both approaches

Case:	ARB MW Corn Ethanol		Energy Allocation	
	Fuel:		EIOH	COB
DGS Treatment:	Displacement Credit	Displacement Emissions	Displacement Credit Allocated Among Liquid Products	
DGS Credit (lb/gal):	5.34	-0.48	5.34	
Com Oil Treatment:	No Upstream Emissions		Allocation	
Glycerin Treatment:	Energy Allocation		Energy Allocation	
Pathway Step	g CO ₂ e/ MJ EIOH	g CO ₂ e/ MJ BD	g CO ₂ e/ MJ EIOH	g CO ₂ e/ MJ BD
Corn Farming	5.59	0.00	5.09	4.84
Agricultural Chemicals	30.19	0.00	27.51	26.15
Corn Transportation	2.19	0.00	2.00	1.90
Fuel Production	38.24	0.00	31.30	29.75
Com Oil Extraction	0.00	12.64	0.00	0.00
Oil Transport	0.00	1.37	0.00	1.37
Biodiesel Production	0.00	4.89	0.00	4.89
Biodiesel T&D	0.00	0.76	0.00	0.76
Ethanol T&D	2.63	0.00	2.63	0.00
Fuel Combustion	0.80	4.45	0.80	4.45
DGS Credit	-11.48	10.58	-9.52	-9.05
Energy Savings	0.00	-29.01	0.00	0.00
Biodiesel Credit	0.00	0.00	0.00	0.00
Glycerin Credit	0.00	0.00	0.00	0.00
Fuel Cycle Direct Emissions (g/MJ)	68.17	5.69	59.81	65.07
LUC Emissions (g/MJ)	30.00	0.00	27.33	25.98
Total Fuel Cycle Emissions (g/MJ)	98.17	5.69	87.15	91.05
Total Fuel Cycle Emissions (g/bu)	21,504	126	19,089	2,024

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Biofuel LCA Recommendations

- Use consistent methodology
- Follow ISO standards
- Maintain technology neutrality
- Do not create lopsided incentives
- Recognize food and fuel impacts

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