

Sustainability Of US Produced Corn Can Support Export Markets

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**THE
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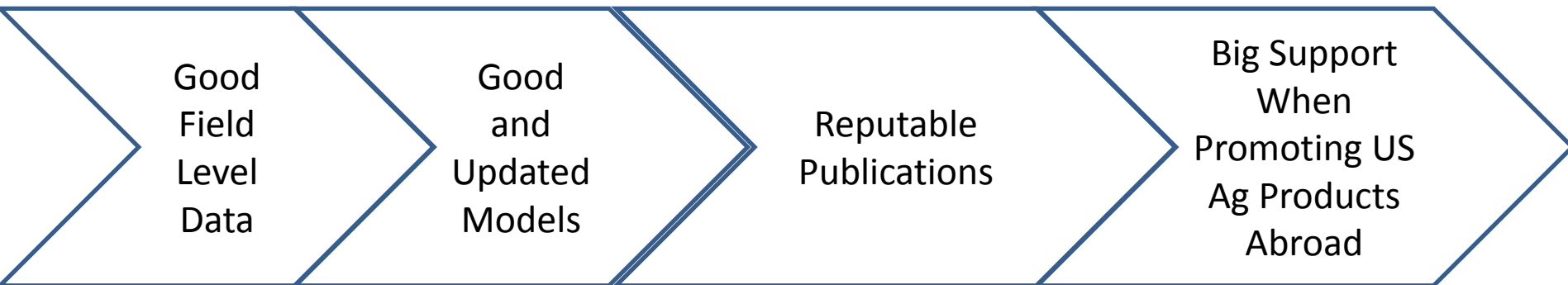


Illinois Corn Board Meeting

January 25, 2017

Champaign, IL

The Importance of Documenting Advances in Agricultural Production Practices



- USDA Surveys
- Ethanol Industry Surveys
- Field to Market
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- Argonne GREET CCLUB
- Daycent
- GTAP
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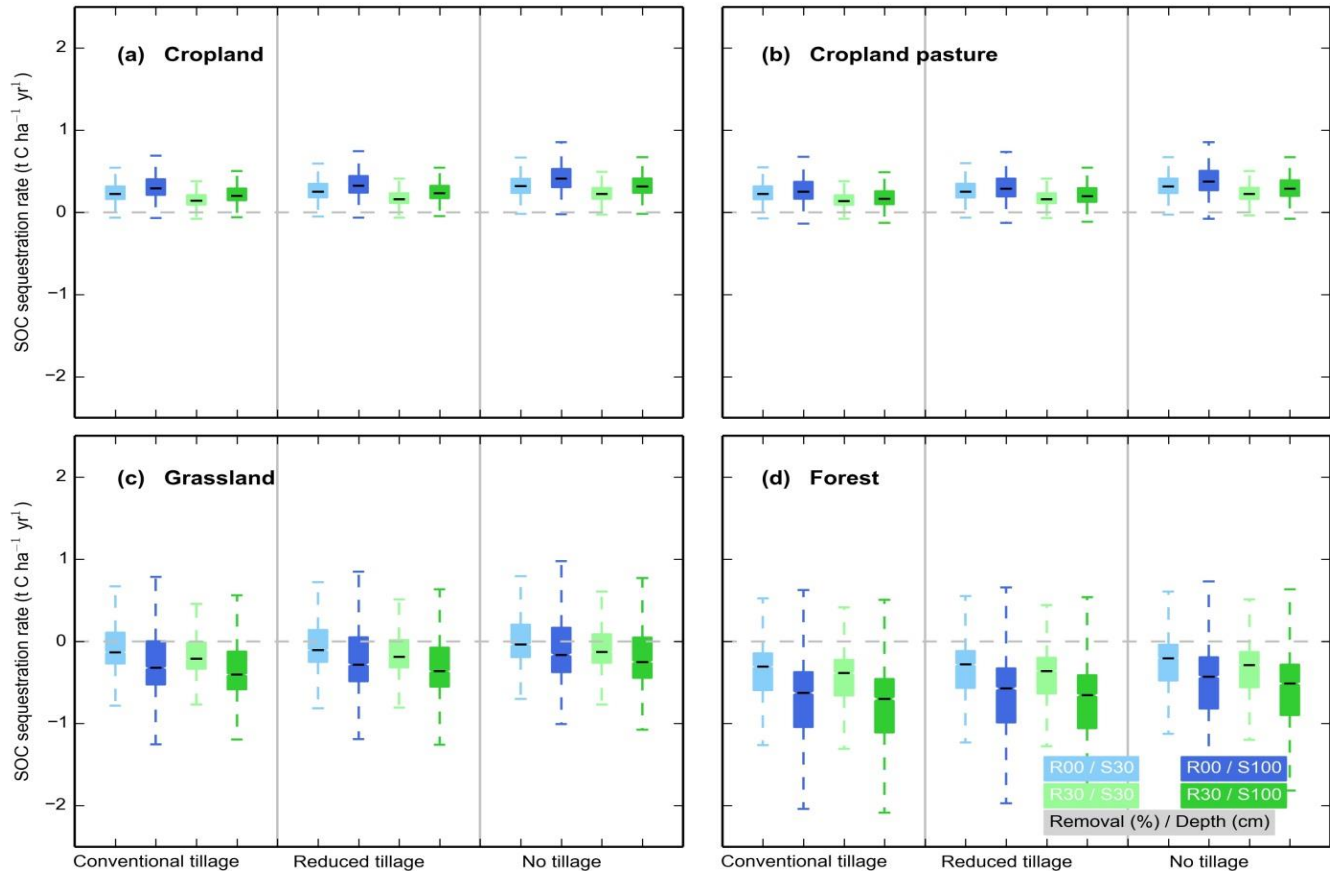
- Latest USDA Ethanol Report
- Argonne Peer Reviewed Publications
- Others: e.g.
 - Babcock/IA State;
 - Clay/ South Dakota
 - Tyner/Purdue

Greenhouse Gas Thresholds by: Japan, EU, Columbia, Ontario
(Also domestically: RFS, California LCFS)

Example 1 - Good and Updated Data: Supporting Data for Sustainable Land Use Argument









- Argonne GREET Carbon Calculator for Land Use Change from Biofuels Production (CCLUB): Soil Organic Carbon Data with High Spatial Resolution & Variation
- Conversion of mixed cropland to corn under different management practices shows increasing soil organic carbon; conversion of grassland or forest shows largely decreasing SOC

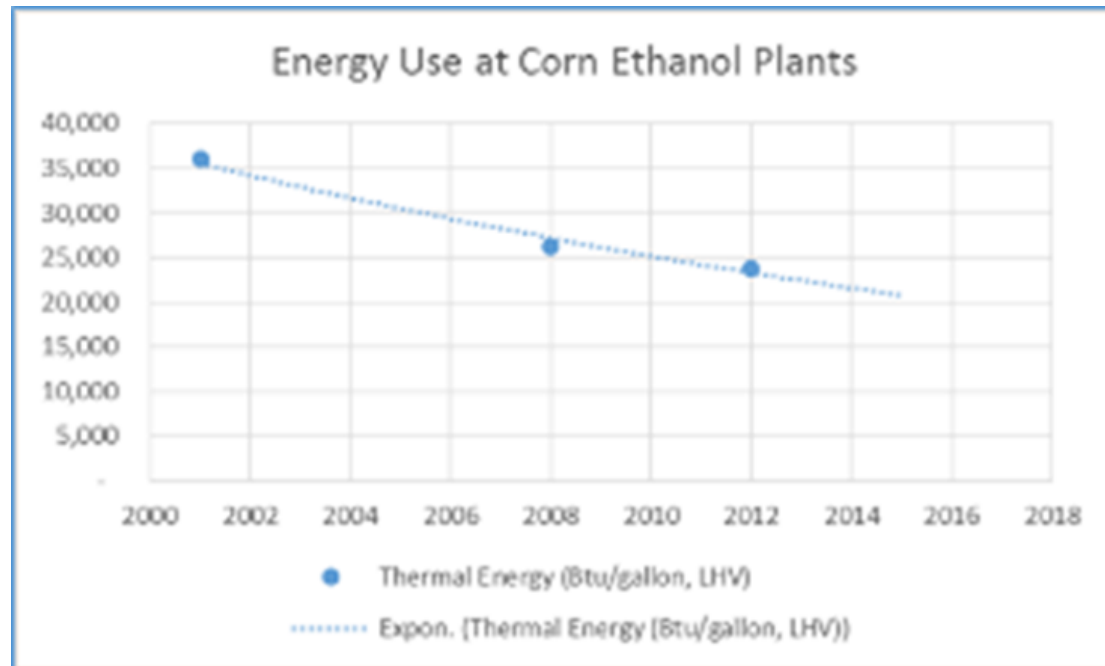


Source: Argonne GREET Group (Qin et al., *GCB Bioenergy*)

Example 2 - Good and Updated Data: Ethanol Efficiency Improvements

- Ethanol Plants over time show increasing yields, decreasing energy use
- Filed for Correction of Information with US EPA based on efficiency improvements of corn ethanol plants and corn agriculture

	2001	2008	2012	Trend
Yield (undenatured, gallon/bushel)	2.64	2.78	2.82	
Thermal Energy (Btu/gallon, LHV)	36,000	26,206	23,862	
Electricity Use (kWh/gallon)	1.09	0.73	0.75	
DDG Yield (dry) incl. corn oil (lbs/bu)		15.81	15.73	
Corn Oil Separated (lbs/bushel)	0	0.11	0.53	
Corn Oil Separated (% of Plants)	0%	33%	74%	
Water Use (gallon/gallon)	5	2.72	2.7	



Good Data Results in Updated Publications: Latest USDA Results on Ethanol Greenhouse Gas Reductions

- USDA report, titled “A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn-Based Ethanol,” finds that greenhouse gas (GHG) emissions associated with producing corn-based ethanol in the United States are about 43 percent lower than gasoline
- “GHG profile of corn ethanol will be almost 50 percent lower than gasoline in 2022 if current trends in corn yields, process fuel switching, and improvements in trucking fuel efficiency continue.”
- On-farm conservation practices, such as reduced tillage, cover crops, and nitrogen management, are estimated to improve the GHG balance of corn ethanol by about 14 percent.

Analysis relies heavily on and cites repeatedly:

J. Dunn, Z. Qin, S. Mueller, H-Y. Kwon, M. Wander, M. Wang ; Carbon Calculator for Land Use Change from Biofuels Production (CCLUB)

Manual; October 07, 2016;

<https://greet.es.anl.gov/publication-cclub-manual>

Data and Publications Help Demonstrate Attractiveness of US Produced Ethanol to Foreign Markets

- Key Arguments for Ethanol Attractiveness in Foreign Markets:
 - Enables foreign governments to meet commitments under Paris Climate Agreement (mentioned specifically by several US Embassies we visited)
 - Combustion Emissions Benefits due to Reduction of Tailpipe Pollutants. Particularly beneficial for highly polluted cities
 - Substitutes for MTBE oxygenate in fuel. MTBE leaks contaminate ground water – significant odor
 - Provides Economic Benefits: Cheaper Oxygenate, Diversification of Fuel Supply
- Key Advantage of US Agriculture: Availability of Data and Updated Models on Agricultural Practices (Nutrient Use, Land Use, Management Practices) Allows us to Support Sustainability Argument

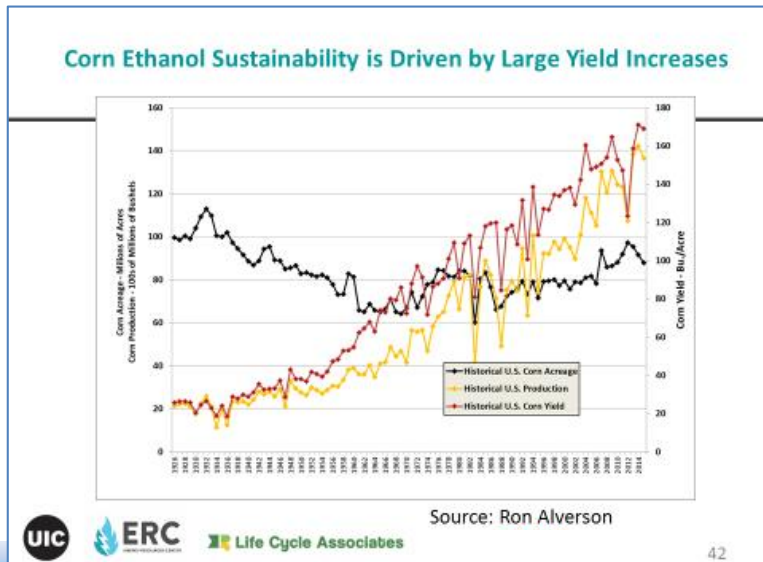
International Activities



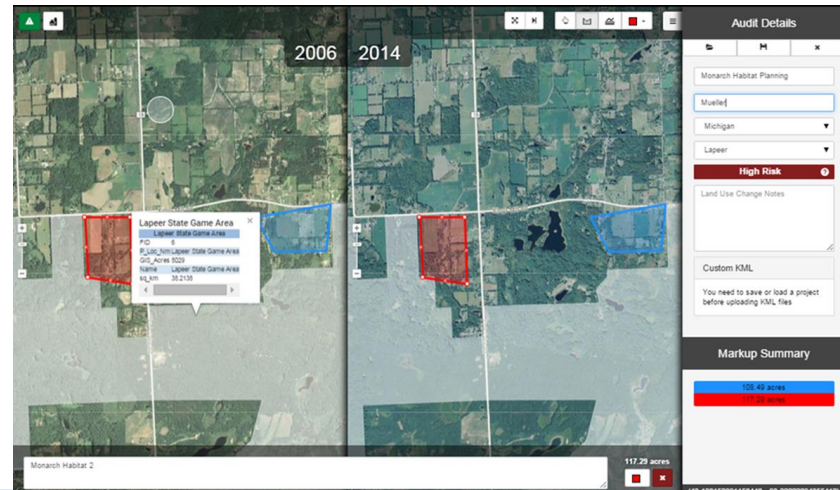
- University of Illinois at Chicago Participated and Presented at US Grains Council Organized Workshops in:
 - Japan (Tokyo 2x)
 - India (Mumbai and New Delhi)
 - Mexico City (2x)
 - China (Beijing and Anhui Province)
 - Korea (Seoul)
- Workshops convene US and Local Experts to Showcase Environmental and Economic Benefits of Ethanol Blends in Gasoline
- Currently working with US Grains Council on Setting up Larger Study on the Long Term Emissions Benefits if Cities adopt Ethanol Now

Japan

- Japan requires 50% GHG Reduction for Biofuels Blended into Fuel Supply
- Currently only met by shipping Sugarcane Ethanol to Houston for conversion to ETBE (Oxygenate) and then shipment to Japan
- Japan is currently updating long term energy goals. Working to qualify US Corn Ethanol under 50% Threshold
 - Showed that US has most detailed data on its land use practices and that corn ethanol sustainability is driven by large yield increases
- Showed that US Corn Ethanol can meet sustainability criteria

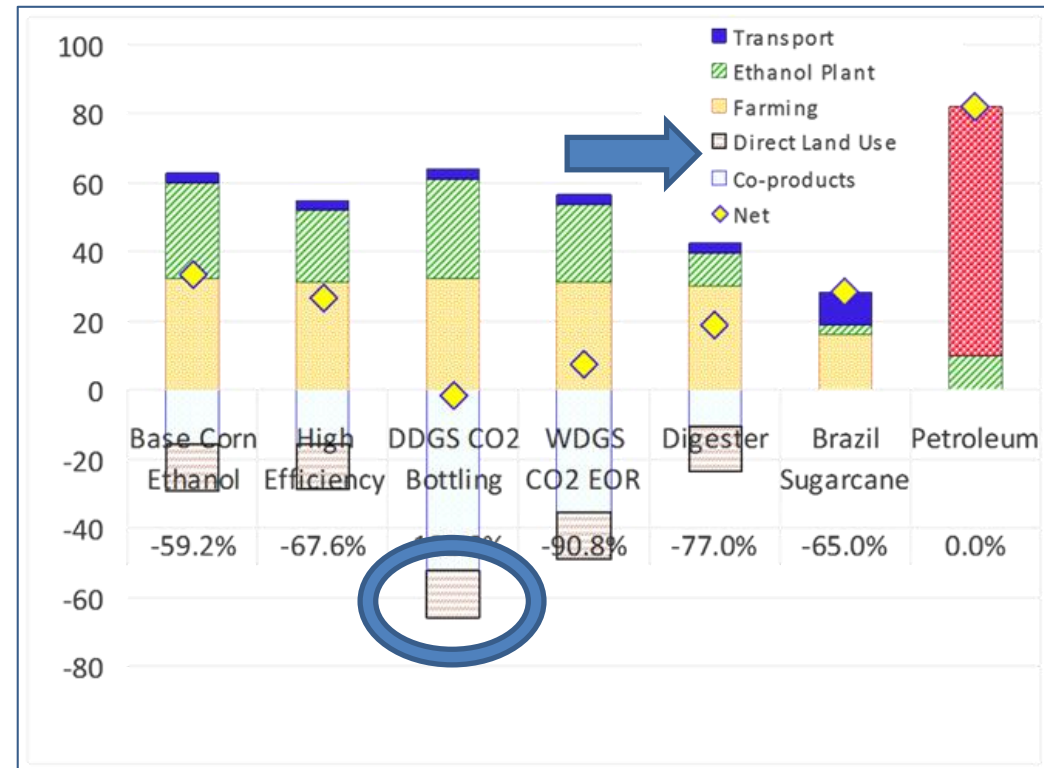


USDA Imagery to Document Mature Land Use



Japan

- UIC Life Cycle modeling showed that many plants can meet 50% Greenhouse Gas Reductions (using EU/Japanese model approach which allows for energy allocation of coproducts and inclusion of ag management practices)
- Included carbon impact of soil carbon accumulation
 - From Reduced tillage practices
 - From high rotation corn agriculture



UIC Life Cycle Analysis with Life Cycle Associates Submitted to Japan

India/China

- Presented Inaugural Address at Workshops in Mumbai and New Delhi; Presented in Beijing
 - Presented on Combustion Benefits
 - Presented on Climate Benefits
- Rapidly Increasing Fuel Use
- Local Provinces can Make Decisions for Higher Ethanol Blends

New Delhi is the most polluted city on Earth right now



By James Griffiths, CNN

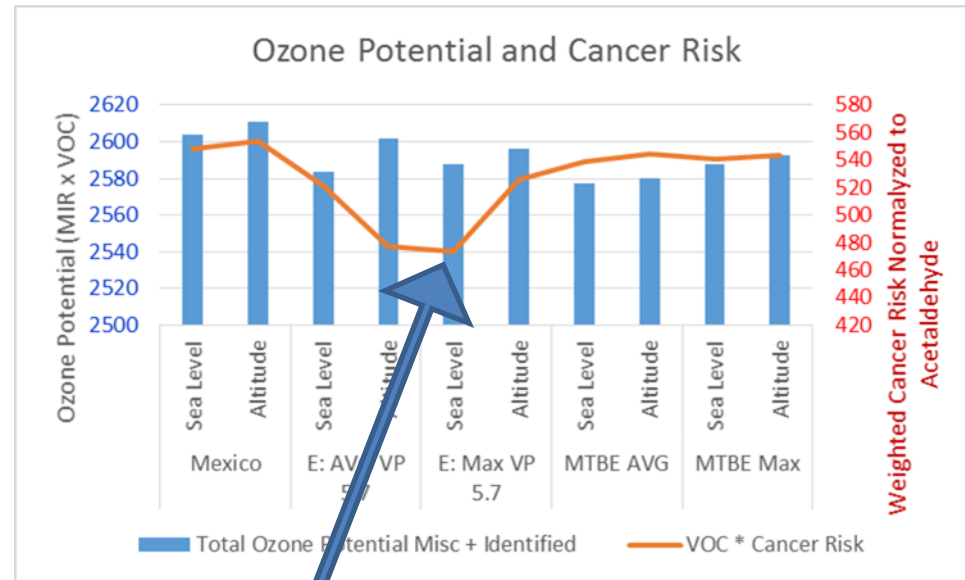
Updated 12:41 AM ET, Tue November 8, 2016



Mexico City:

UIC Conducted Comprehensive Study of Ethanol Benefits for Mexico City Air Quality

- Mexico just started to allow ethanol blends but still excludes 3 main cities
- UIC conducted study in support of using ethanol in these 3 cities
 - Obtained Mexico City fuels samples
 - Determined Vehicle Fleet Age
 - Adjusted EPA MOVES to determine impact of ethanol blends.
 - Showed reduction in cancer risk from ethanol use in Mexico City



Mexico City MOVES Modeling Shows Reduction in high Cancer Risk Pollutants from Ethanol Blends

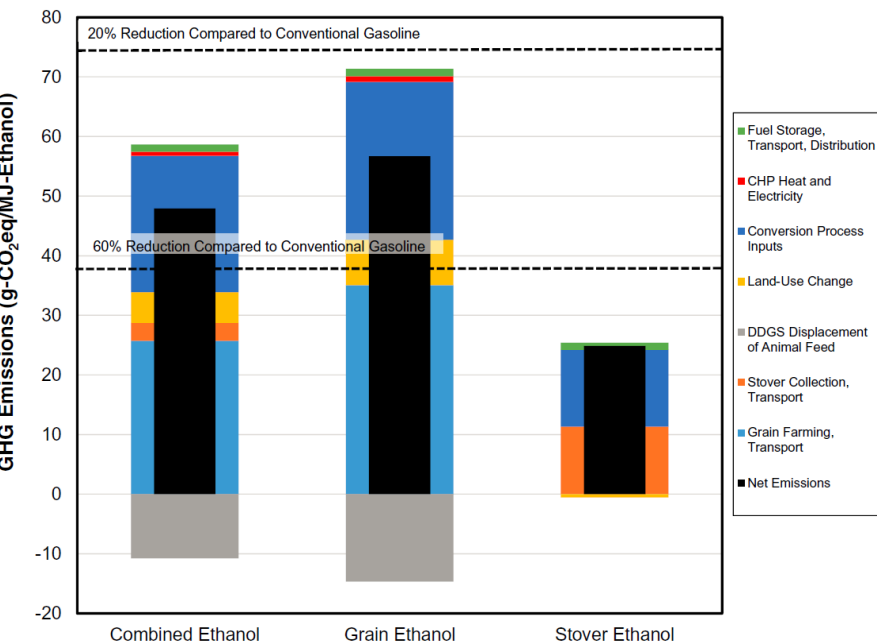
Columbia/Korea/Canada

- Columbia Drafting 60% GHG Reduction Target for Biofuels
 - US Grains Council Commented to ensure harmonization
- Korea: Large fuel market. Closely watching Japanese approach
- Currently in development: Ontario Low Carbon Fuel Standard

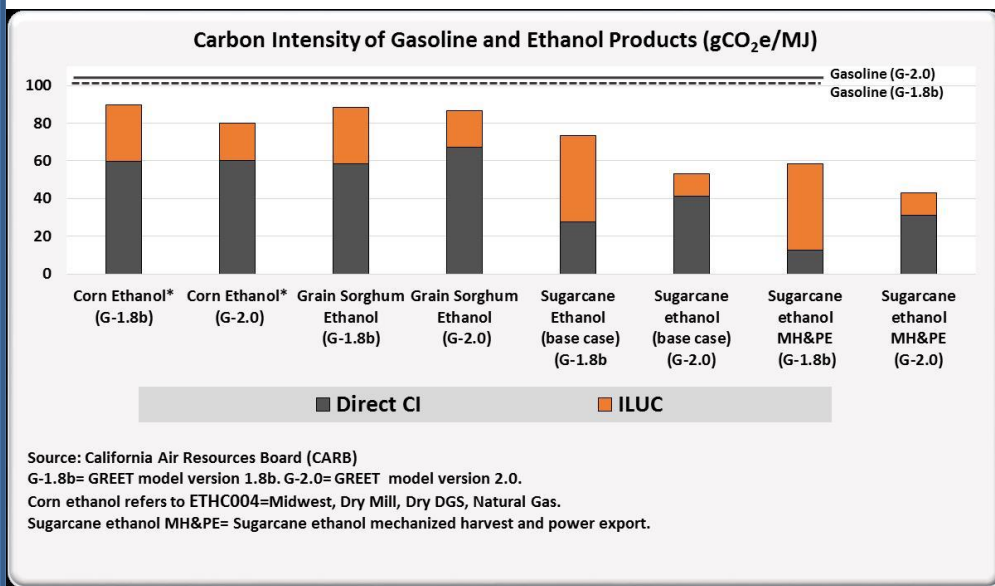
Need to Promote Latest Data: California CARB compared to Latest Argonne GREET

Data on Ethanol Efficiency Must Work its Way into CARB/EPA

GREET (dry grind, natural gas, CHP):
Less than 60 gCO₂/MJ with Land Use Change



CARB (dry grind, natural gas)
80gCO₂/MJ with Land Use Change



Source: AgMRC

<http://www.agmrc.org/renewable-energy/renewable-energy-climate-change-report/renewable-energy-climate-change-report/may-2016-report/readoption-of-the-california-low-carbon-fuel-standard/>

Need to Keep Data Current

- USDA Report: “If additional conservation practices and efficiency improvements are pursued, such as the practices outlined in USDA’s Building Blocks for Climate Smart Agriculture and Forestry strategy, the GHG benefits of corn ethanol are even more pronounced over gasoline—about 76 percent.”
- Need to keep documenting conservation practices: Field to Market, AgSolver, aggregated carbon factors (EU Exports)

Current UIC Scientific Activities



- Collaborate with Argonne National Laboratory on several publications to document soil organic carbon accumulation from corn agriculture under different management practices
- A just released publication between UIC/Argonne compares error of remote sensing tools. Information can be used to assess/question accuracy of reports that assert large land use expansions in sensitive areas such as Prairie Pothole Region
- Collaborate with Seed Producer on climate strategies
- Inform and update Environmental Models:
 - Example: Work to update EPA Vehicle Emissions Model (MOVES) to work correctly for high ethanol blends
 - Example: Work to study air impact from higher ethanol blends in key polluted cities around the globe
 - Example: Work to properly account for the benefits of coproducts produced from corn during ethanol conversion. Just over last month worked on the value of CO₂ recovery at ethanol plants for the merchant gas markets (beverage bottling, food industry, etc.)

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