Steffen Mueller, PHD
Summary Points at United Nation's COP23 Meeting in Bonn, Germany
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It is a distinct honor to present my research and scientific insights here at COP23 and represent the University of Illinois at Chicago at this event.

At my research Center at UIC we have worked on sustainability and ghg pathways of first and second generation ethanol for 15 years. Here is a quick summary of our activities:

- I am heading the Biofuels and Bioenergy Research Center at UIC
- We were part of the Expert Working Group during the creation of the California Low Carbon Fuel Standard
- My research group provided data to US EPA during RFS2 Development
- In 2014 we presented our data to the White House Council of Economic Advisors under Obama
- We publish widely on soil carbon effects of corn and second generation ethanol production
- I sit on the Board of ISCC, Europe's largest Biofuels Certifier
- I am the coauthor of the CCLUB model which is the iLUC interface to Argonne GREET
- I am a member of the Ag Auto Ethanol working group, which supports high octane work and high ethanol blend gasoline work

- We support Monsanto's Carbon Neutral Agriculture Initiative, a current USDA Conservation Innovation Grant for agriculture, the Illinois Corn Growers conservation management initiatives with our data.
    - We show that corn agriculture in most geographic regions increases soil carbon
- We have coauthored more than 20 peer reviewed publications
    - On efficiency improvements at corn ethanol plants
    - On soil carbon sequestration effects from corn production
    - On the use of satellite imagery to detect land use and land use change
- We are also very active in Pollinator research and habitat restauration along utility, railroad, and road right of ways. This research is supported with substantial grants from the US Fish and Wildlife Service and the National Fish and Wildlife Foundation.

I want to address two main points:

1. Corn Ethanol Provides Significant GHG Reductions Regardless of the Model Used and the Regulatory Framework.
2. The costs of these GHG reductions are negative meaning we gain economic return from utilizing corn ethanol. While the stabilization effect of crop prices with corn ethanol is well understood we at UIC are also releasing a study that shows that refiners around the world can make money from substituting petroleum based octane with ethanol.

GHG Reductions from Corn Ethanol

Existing and emerging GHG regulations in US, Columbia, Japan, Brazil, Canada, all recognize corn ethanol as a contributor to reduced GHG emissions. Corn Ethanol shows significant reductions in GHG emissions between 30-60%:

1. Regardless of the Regulatory or Incentive Structure Employed: In general we distinguish between performance based requirements and volumetric/energetic blending requirements. RFS2 provides volumetric blending requirements for biofuels whereas Fuel suppliers under the LCFS

need to meet performance based GHG reduction targets from a fuel mix of their choice. EU is in line with a volumetric requirement.

2. Regardless of the Life Cycle Model used: US GREET with iLUC interface CCLUB, Canada's GHGenius, Biograce,
3. Regardless of coproduct allocation, meaning the way we credit ethanol production for animal feed coproduct.
4. Regardless of whether a country or region requires third party certification of the GHG reductions and additional sustainability metrics. For example 22 US corn ethanol plants were certified in 2010/11 to export to the EU.

I want to mention some of the latest data including the latest USDA Study which shows a 43% reduction over gasoline.

Results from New Study

As mentioned above these GHG savings can be achieved with negative costs meaning a gain in economic return from utilizing corn ethanol. We have a new study coming out with support from the US Grains Council that looks at five global cities and how the refinery structure would actually increase revenue from blending while producing GHG savings. The purpose of this study coauthored by the University of Illinois at Chicago (UIC) Energy Resources Center is to assess the cumulative future emissions benefits and GHG benefits from adopting higher ethanol blends such as E10 and 20 for the light duty vehicle market. Assesses Impact on Revenues to Local Refineries from Switching to Ethanol Blends

- Cities Studied: Beijing, Mexico City, New Delhi, Seoul, and Tokyo, all of which face major air quality challenges.
- Based on actual fuel samples taken in Each City/ Region
- Integrates US Environmental Protection Agency's Complex Model used by refiners with UIC iBEAM Model
- Considers city specific fuel consumption, emissions standards, and vehicle control technologies
- Incorporates the latest scientific literature on E10 and E20 ethanol-gasoline blends

- Includes an assessment of air toxins, polycyclics, total hydrocarbons (THC), oxides of nitrogen (NOx), carbon monoxide (CO), and Particulate Matter (PM).
- Some key findings:
    - In a refinery the Catalytic Reformer Unit is the major producer of high octane for gasoline blending.
    - When oxygenates (like ethanol in E10 or E20) are added in gasoline blending, there is less need for octane from the catalytic reforming unit.
    - However, the catalytic reforming unit is an important source of hydrogen in the refinery.
    - So blending ethanol causes a trade off within a refinery between revenue from extra volume and potential cost from having to produce additional hydrogen.
    - Linear Refinery Programming Showed that these Ethanol Blends Given Each Country's Refinery Structure can be Produced with Additional Profits to the Refining Sector.
    - Because of the substitution of Benzene etc. we also see a dramatic reduction in air toxins and other criteria pollutants across the air sheds of the studied cities.
    - In a next step we are now assessing the full ghg life cycle savings from these fuels in each city.