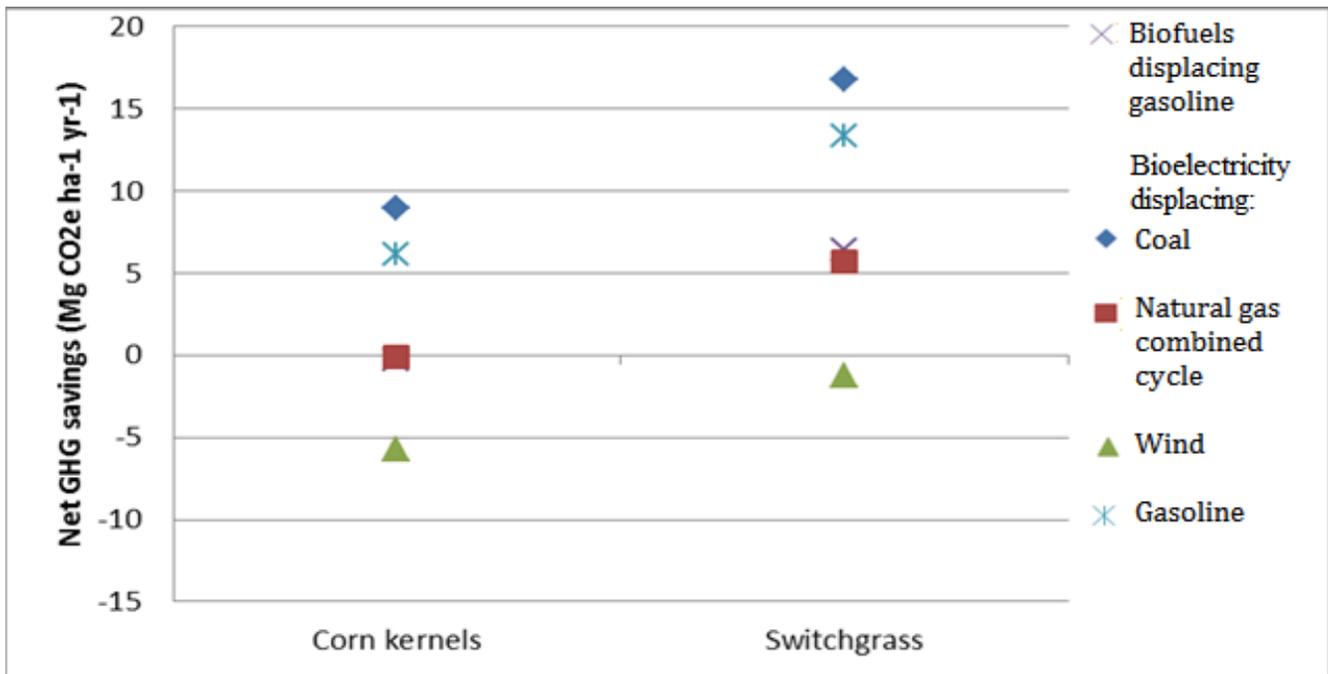


Greenhouse gas emissions are one of the many factors used in comparing the sustainability level of various energy sources. Greenhouse emissions from fossil fuels are generally greater than emissions from biomass derived fuels. However biomass fuels can also vary greatly with respect to levels of greenhouse gas emissions depending on the biomass resource used, how those resources were produced or collected, and the biomass to energy conversion technology pathway. One way of obtaining a sense of the difference in emissions between fossil fuels and various biomass energy technology pathways is to evaluate net greenhouse gas savings based on which fossil fuel source is being displaced. Such an evaluation has been recently performed comparing corn grain and switchgrass as the biomass feedstock for production of liquid transportation fuels, electric transportation, and electricity for other uses.

Section: INTRODUCTION

A Comparison of Climate Impacts of Various Bioenergy Systems



This figure (from Lemoine et al 2010) shows that net GHG savings per area of cropland are sensitive to assumptions about which fossil fuel technology is being displaced. The X marker shows ethanol displacing gasoline. The blue asterisk follows a study by Campbell et al (2009) in assuming that bioelectricity is used to power electrified vehicles and displaces gasoline. The diamond, square, and triangle (coal, natural gas combined cycle, and wind electricity) show the GHG benefit (or cost) when bioelectricity displaces each of these types of power. Corn grain production is assumed to have an indirect land use effect of 30g CO₂e (MJ ethanol)⁻¹ while switchgrass is assumed to be planted on Conservation Reserve Land with no indirect land use effect but also no soil carbon sequestration.

Sources:

Lemoine, D.M. et al. The Climate Impacts of Bioenergy Systems Depend on Market and Regulatory Policy Contexts. *Environmental Science & Technology* 44:7347-7350

Campbell, J.E.; Lobel, D.B.; Field, C.B. Greater transportation energy and GHG offsets from bioelectricity than ethanol. *Science* 2009, 324, 1055-1057.

Supplementary material including a complete description of the Energy Displacement Model is available free of charge at <http://pubs.acs.org>.