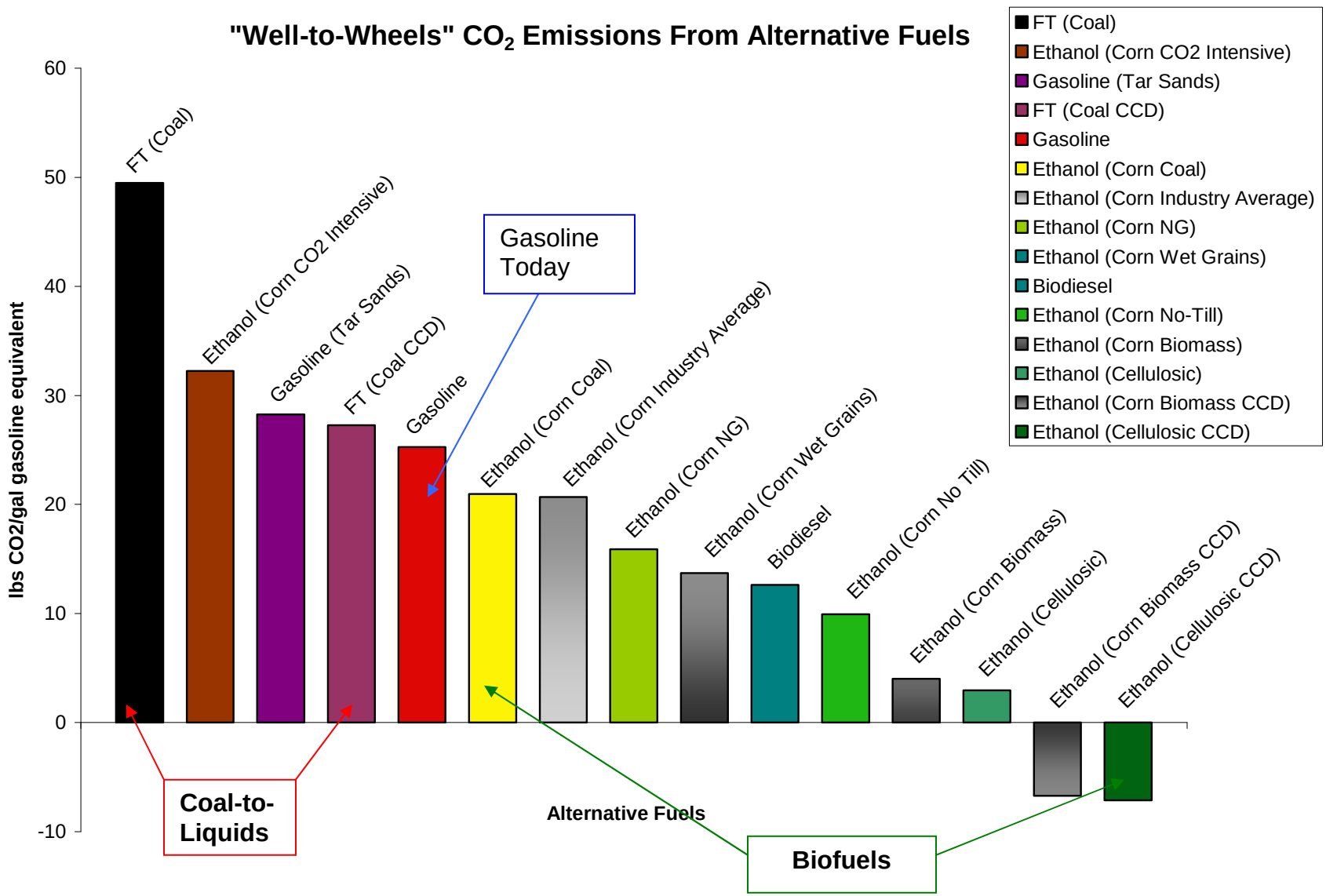
"Well-to-Wheels" CO_2 Emissions From Alternative Fuels
lbs CO2/gal gasoline equivalent
60
50
40
30
20
10
0
-10
FT (Coal)
Ethanol (Corn CO2 Intensive)
Gasoline (Tar Sands)
FT (Coal CCD)
Gasoline
Ethanol (Corn Coal)
Ethanol (Corn Industry Average)
Ethanol (Corn NG)
Ethanol (Corn Wet Grains)
Biodiesel
Ethanol (Corn No Till)
Ethanol (Corn Biomass)
Ethanol (Cellulosic)
Ethanol (Corn Biomass CCD)
Ethanol (Cellulosic CCD)
Gasoline Today
Coal-to-Liquids
Alternative Fuels
Biofuels

This chart compares the well-to-wheels (or full fuel cycle) emissions from alternative transportation fuels in pounds of CO_2-equivalent per gallon of gasoline energy content equivalent. The basis for each bar is described briefly below:

FT (Coal): Fischer-Tropsch fuel produced from coal. Based on a stand-alone plant (R. Williams, Princeton University).

Ethanol (Corn CO2 Intensive): Ethanol produced from corn using coal for process energy at the ethanol plant, with energy intensive agriculture and long distances traveled from farm to biorefinery. (based on Farrell et al., EBAMM model)

Gasoline (Tar sands): Gasoline made from synthetic petroleum produced from Canadian tar sands. (Based on *Oil Sands Fever*, Pembina Institute, November 2005)

FT (Coal CCD): Fischer-Tropsch fuel produced from coal with carbon dioxide capture and disposal (CCD) from the production plant. Based on a stand-alone plant (R. Williams, Princeton University).

Gasoline: Conventional gasoline, including upstream emissions. (Based on Argonne GREET model)

Ethanol (Corn Coal): Ethanol produced from corn using coal for process energy at the ethanol plant and assuming energy intensive agriculture. Based on Farrell et al., 2006. *Science* **311**:506.

Ethanol (Corn Industry Average): Estimate of the national average emissions rate from the current mix of fuel used for ethanol production and the current mix of dry and wet mills. Based on Farrell et al., 2006. *Science* **311**:506.

Ethanol (Corn NG): Ethanol produced from corn using natural gas for process energy at a dry mill ethanol plant. Based on Farrell et al., EBAMM model.

Ethanol (Corn Wet Grains): Same as Corn NG, except that plant sells wet distiller grains as a coproduct, saving the cost of drying the grains. (Based on Farrell et al., EBAMM model, and M. DeLucchi, University of California, Davis, 2003)

Ethanol (Corn No Till): Same as Corn Wet Grains, except that corn is grown without tilling, reducing both fuel and nitrogen emissions. This number is based on averages of 14 counties in the U.S. following no-till practices; it is not a national average. (Based on Farrell et al., EBAMM model; Kim & Dale, *Biomass and Bioenergy* 28: 475-489, 2005)

Ethanol (Corn Biomass): Same as Corn No Till, except that biomass is used for process energy. (Based on Farrell et al., EBAMM model)

Ethanol (Cellulosic): Ethanol produced from cellulosic biomass using biomass for process energy. Based on Farrell et al., EBAMM model.

Ethanol (Corn Biomass CCD): Ethanol produced from corn using biomass for process energy at a dry mill ethanol plant with capture and disposal of the CO_2 produced from the fermentation process. Corn is grown with no-till practices and plant sells wet grains. Based on Farrell et al., EBAMM model subtracting fermentation CO_2 of 6.6 pounds of CO_2 per gallon of ethanol. (http://www.kgs.ku.edu/PRS/Poster/2002/2002-6/P2-05.html)

Ethanol (Cellulosic CCD): Ethanol produced from cellulosic biomass using biomass for process energy with capture and disposal of the CO_2 produced from the fermentation process. Based on Farrell et al., EBAMM model subtracting fermentation CO_2 of 6.6 pounds of CO_2 per gallon of ethanol. (http://www.kgs.ku.edu/PRS/Poster/2002/2002-6/P2-05.html)

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