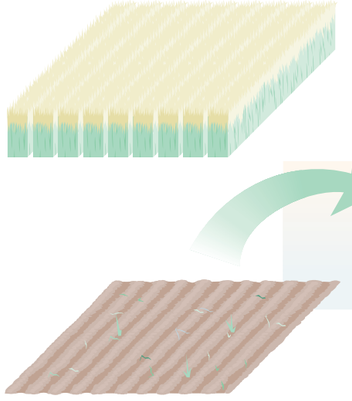
Ethanol vs. Electricity

The Land

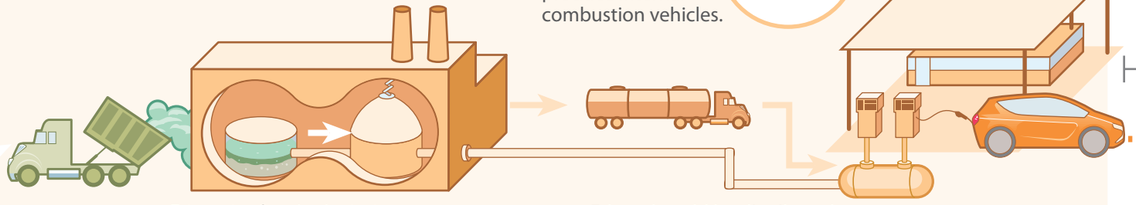
Only a limited area of cropland is available to grow biofuel crops without causing an increase in food prices or deforestation.

The Choice

The plant biomass grown on this limited land could be used for transportation via different energy pathways such as ethanol and electricity.



Biomass into ethanol



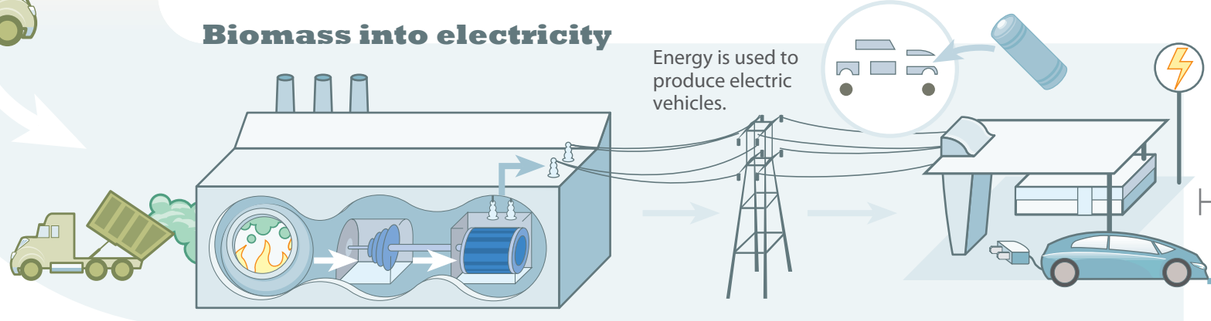
Ethanol refineries include pre-treatment, biological treatment and purification steps.

Ethanol could be distributed by truck or pipeline.

Energy is used to produce internal combustion vehicles.

Ethanol is pumped at fuel stations.

Biomass into electricity



Biomass is burned to make steam.

Steam turns a turbine.

The turbine turns a generator.

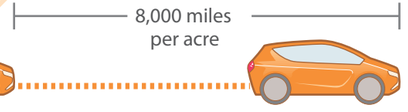
Electricity is transmitted through the grid.

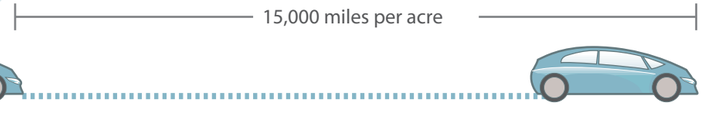
Energy is used to produce electric vehicles.

Batteries are charged at fuel stations, homes, and businesses.

The Result

Using the biomass to produce electricity for electric vehicles would produce 81% more transportation than using the same amount of biomass to produce next-generation ethanol for internal combustion engine vehicles. The electricity option also has a greater potential for reducing CO_2 emissions than ethanol.





The miles that could be driven using the annual harvest from one acre of cropland vary for different factors such as crop yield and vehicle class. The example shown here is for a switchgrass crop and a small SUV.

Credit: McDade and Campbell / UC Merced
Based on: Campbell et al. Science 2009