Biofuels for Aviation Summit
Panel on Sustainability
Processing or Conversion

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What are the major differences in sustainability among processing options?

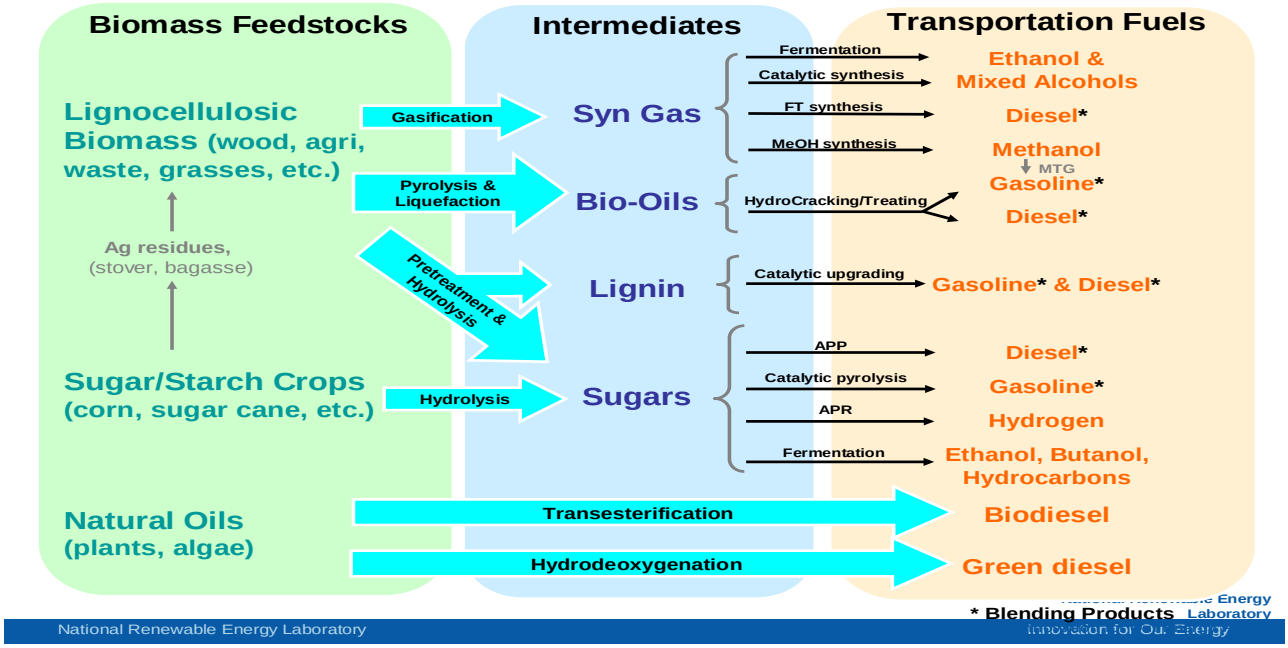
Overview

A comprehensive evaluation of the sustainability characteristics of bioenegy system options requires an in depth analysis of many different components or factors. This would include: greenhouse gas emissions, land use, water use, biodiversity, air quality, economic prosperity, and social well being. Sustainability may often be couched as encompassing all environmental impacts with a goal to increase food, fuel, and energy security while safeguarding soil, water, and biodiversity. The "big three" factors that dominate most analyses and discussions are identified for this panel discussion as: land use changes and availability, water use and quality, and greenhouse gas and other air emissions. A rigorous approach to address sustainability questions is typically done through life cycle assessment (LCA) that is a cradle to grave evaluation for the entire fuel cycle. The principle steps are feedstock growth, feedstock transport, processing or conversion, distribution of fuel products, and end use for transportation or other use.

Comparison of Processing or Conversion Options

This panel is to address the impact on sustainability of different processing or conversion options. For biofuels transportation applications numerous alternatives are available with multiple steps being the norm so that the total number of possible combinations is a large number. As a result, detailed analysis has not been developed for many of the processing or conversion steps in the fuel pathway route. Figure 1 illustrates these possible routes.

It is recognized that there has not been a comprehensive comparison of LCAs and sustainability analysis for many of the possible biofuels pathway routes in the US. The most widely studies have been greenhouse gas emissions and even that has been limited to a fraction of the total possible routes.



In a report to be published in Environmental Science & Technology by Williams, Inman, Aden, and Heath the environmental and sustainability factors of next generation biochemical and thermochemical platform biofuels are compared. This manuscript has provided an extensive list of literature citations and represents an important contribution in bringing information on this topic together. Comparisons are made for the processing or conversion steps for greenhouse gas emissions, air pollution emissions, water use, wastewater, and solid waste. The comparisons are for ethanol as the fuel from both platforms and a brief summary of the results are described here. Both platforms have similar carbon dioxide and air pollution emissions; however, the biochemical process has 2-10 times greater sulfur dioxide emissions and the thermochemical process has 2-17 times greater nitrogen oxide emissions. Water use is 2-4 times greater for the biochemical process and the thermochemical process is expected to have wastewater that requires off-site treatment.

Analyses of other biofuels pathways are needed to provide a more complete comparison of the alternative processes. At the same time additional research is needed to both understand the performance characteristics of the processes and to optimize the efficiencies of these processes.