LIFE CYCLE EVALUATION OF PYROLYSIS FUEL PATHWAYS

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Biofuels are currently under development to meet federal and state goals for diversifying energy supply, reducing the carbon-intensity of transportation and other sectors, and stimulating economic growth in rural parts of the U.S. Policy instruments such as the federal Renewable Fuel Standard (RFS2) have been signed into law to stimulate the development of domestic renewable fuels and address climate change from those energy sectors. Upgraded bio-oil produced from the fast pyrolysis of biomass is under development as a "drop-in" fuel for transportation markets as required by the U.S.'s Energy Independence and Security Act (EISA). We investigate the life cycle environmental impacts of a petroleum blendstock produced from forest residue feedstocks from the U.S. Northeast via fast pyrolysis and upgrading. Specifically, we use life cycle assessment (LCA) to construct a model for the harvest and size reduction of woody biomass, followed by fast pyrolysis, hydrotreating and hydrocracking. Bio-char is a co-product from fast pyrolysis that may be sold as a land amendment in agriculture or for energy substitution (e.g., for coal). Among the metrics we investigate are greenhouse gas (GHG) emissions for chipping and grinding operations, transportation to a centralized (1000 dry metric ton/day) pyrolysis facility and conversion to biofuel. The results show GHG emissions range between 23 and -29 g CO_2e/MJ depending on whether the biochar is used as a land amendment, or whether it is used for energy, respectively. This talk explores how life cycle assessment (LCA) tools have been applied to characterize the environmental performance of emerging biofuels conversion technologies from one thermochemical platform. The talk also highlights how LCA has been used to guide planning and energy policy for biofuel conversion technology under development in the U.S.