There is much interest in using renewable biomass resources to meet demand for fuels and chemicals. Algal biomass is an attractive renewable feedstock because it requires less land area and has a higher photosynthetic efficiency than terrestrial biomass and it does not involve a food/feed vs. fuel competition as does corn ethanol or soy biodiesel. Being aquatic plants, harvested microalgae carry with them tremendous amount of water. Conventional algal bioenergy processes (e.g., lipid extraction for biodiesel production) first remove the water and then process the dried biomass. This drying step is costly and energy intensive. Thus, there is a need for wet biomass conversion processes that operate in the aqueous phase. We are helping to develop the chemical kinetics and reaction engineering foundations for hydrothermal processes that can convert wet biomass into biofuel intermediates directly (no drying) and thereby reduce process energy demands for biofuel production. This talk will outline recent progress made in understanding and optimizing the use of hydrothermal liquefaction for converting wet biomass into liquid fuels. Advancements in molecular characterization of the reaction products, understanding the hydrothermal reaction pathways and kinetics for biomass and model biomolecules, and reaction modeling will be highlighted.