In the past decade over $1.0 billion in private and public funds has been spent on the development of pioneer technologies for the conversion of lignocellulosic biomass into liquid transportation fuels and chemicals. Several of these technologies have failed at the commercial level and several of these companies have now gone bankrupt. The failure of these technologies is due to two fundamental reasons: 1. economic estimates under predicted the costs of these technologies; and 2. pilot and demonstration plants operated well below their designed capacity. In this presentation we will first present a predictive model on how to estimate the economics and operability of pioneer technologies. I will then discuss different approaches for the production of renewable fuels and chemicals that are being developed both inside the Huber research group. The objective of the Huber research group is to develop pioneer catalytic processes and catalytic materials for the production of renewable fuels and chemicals from biomass, solar energy, and natural gas resources. We use a wide range of modern chemical engineering tools to design and optimize these clean technologies including: heterogeneous catalysis, kinetic modeling, reaction engineering, spectroscopy, analytical chemistry, nanotechnology, catalyst synthesis, conceptual process design, and theoretical chemistry. Hydrodeoxygenation (HDO) is a platform technology used to convert liquid biomass feedstocks (including aqueous carbohydrates, pyrolysis oils, and aqueous enzymatic products) into alkanes, alcohols and polyols. In this process the biomass feed reacts with hydrogen to produce water and a deoxygenated product using a bifunctional catalyst that contains both metal and acid sites. The challenge with HDO is to selectively produce targeted products that can be used as fuel blendstocks or chemicals and to decrease the hydrogen consumption. We will then describe a multi-step catalytic approach for conversion of cellulose into 1,6-hexanediol and hemicellulose into 1,5 pentanediol. These α,ω-diols are high-volume (130,000 tons/year), high value ($4,600/ton) commodity chemicals used in the polymer industry. Cellulose is first converted levoglucosan which is then dehydrated into levoglucosenone (LGO) in the condensed phase with dilute acid using a polar, aprotic solvent. The LGO is then hydrogenated into dihydrollevoglucosenone, levoglucosanol, and tetrahydropyran-2-methanol (THPM). The THPM then undergoes selective C-O-C hydrogenolysis to produce 1,6-hexanediol using a bifunctional catalyst with > 90% selectivity to 1,6 hexanediol. The hemicellulose is converted into furfural which then undergoes a series of reactions to produce 1,5 pentanediol.