Abstract: Carbon is, and will continue to be, critical to our product- and energy-driven economy, thus steps need to be taken to effectively manage carbon across sectors, with an emphasis on improving carbon conversion efficiency and utilization of waste carbon sources. Emerging technologies for carbon utilization from biomass and waste feedstocks not only face technological hurdles, but also need to be successful in a world marked by exponential rates of technology advancement, rapid technology adoption, high market volatility, and regulatory uncertainty. One approach to overcome these hurdles is through designed resilience, developing versatile technology platforms with feedstock flexibility and product tunability. This presentation will discuss our ongoing efforts to develop two versatile catalytic technology platforms: catalytic fast pyrolysis and indirect liquefaction through dimethyl ether. By coupling foundational science, applied engineering, and technoeconomic analysis, targeted catalyst advancements have been achieved that resulted in improvements in carbon efficiency and product tunability. These catalyst advancements will be described from both (1) a fundamental perspective regarding structure-function relationships and (2) an applied perspective assessing the value proposition of the materials leveraging our recently-released CatCost tool. CatCost is a free, publicly-available, state-of-the-art tool for estimating the bulk-scale production costs of pre-commercial catalytic materials and can be found at https://catcost.chemcatbio.org. Lastly, future opportunities for resilient technology platforms enabled by tunable catalysis will be discussed.

Biography: Josh Schaidle is director of the Chemical Catalysis for Bioenergy (ChemCatBio) Consortium and lead for the Catalytic Carbon Transformation platform within the National Bioenergy Center at the National Renewable Energy Laboratory. Research in this platform ranges from atomistic-scale modeling of catalytic surfaces and reactor flow dynamics to pilot-scale verification of biomass-to-fuels processes coupled with techno-economic analysis and life cycle assessment. Josh received his B.S. in Chemical Engineering from the Univ. of California-Santa Barbara in 2006 and his Ph.D. in Chemical Engineering from the Univ. of Michigan in 2011, with a concentration in environmental sustainability. He seeks to advance the catalysis and bioenergy fields by working at the interface of foundational science and applied engineering, leveraging a combined experimental and computational approach.