

EEE Research Seminar

Date: November 8, 2022 at 10:30 AM

Location: POTR 234 (Fu Room)

John Mulrow, PhD

Visiting Assistant Professor

Environmental and Ecological Engineering
Purdue University



Powered by materials: Evaluating and comparing energy system impacts in a post-fossil fuel world

Abstract

Fossil and non-fossil systems increasingly coexist during the climate-motivated energy decarbonization transition. Although non-fossil systems generally carry lower climate risk, they have other resource and environmental implications that need to be carefully considered, like material intensity and land area. Existing metrics are heavily oriented around fossil systems and often create confusion and accounting inconsistencies when applied to non-fossil systems.

In this seminar, I will outline a material stock and flow model aimed at describing fossil and non-fossil energy systems through equivalent system boundaries, what I call an energy-material circuit (EM-circuit). Applying this model to combustion-based and electric vehicles, I will present some initial measurements of material, primary energy, and solar energy intensities of these systems. Just as we can evaluate the non-renewable material component of driving a solar-electric vehicle, we can evaluate the solar-intensity of driving a fossil-fueled vehicle!

The EM-circuit model points to a more material-focused way of viewing energy systems, one that moves us beyond the fossil fuel-oriented terminology that divides energy systems into outdated categories like renewable versus non-renewable. Shifting terminology in this manner could help bridge the conceptual gap between aspirations of meeting sustainability goals and the actual material-energy impacts of all types of energy systems, as we transition to a post-fossil fuel world.

Bio

Dr. Mulrow's research examines the ecological risks and opportunities of decarbonization, electrification and efficiency gains. Building on the tools of life cycle assessment (LCA) and greenhouse gas footprinting, he aims to fill methodological gaps in environmental impact assessment, especially those that ignore macro-scale effects of increasing affluence, convenience, and efficiency. His recent research is focused on the transportation sector, looking especially at the impact of building out and operating electric vehicle charging infrastructure.

Dr. Mulrow's career experience includes planning and impact assessment for the solid waste management sector, urban farming and composting in Chicago, and emergency response operations for the U.S. Army National Guard. He holds a PhD and MS in Civil Engineering from the University of Illinois at Chicago and BS in Earth Systems from Stanford University.