

EEE Research Seminar

Date: April 11, 2023 at 10:30 AM

Location: POTR 234 (Fu Room)

Jennifer Dunn, Ph.D.

Associate Professor

Departments of Chemical & Biological
Engineering and Mechanical Engineering
Northwestern University



Life Cycle Assessment: Methodology Development and Application Towards Addressing Energy, Water, and Materials Challenges

Abstract

Life cycle assessment (LCA) can guide technology and policy developers towards solutions that move society towards sustainability in the interconnected spheres of energy, materials, and water. Most of these transitions have potential pitfalls that LCA can help us anticipate and possibly mitigate. This seminar will address three examples of our group's development and application of LCA methods towards sustainable societal transitions. The first addresses the role of biofuels as complementary to electrification in the transportation sector. How can we use biofuels to a greater extent without incurring substantial land use change greenhouse gas emissions that might negate their benefit? Our work in this area encompasses a scenario analysis of biofuel deployment towards hard-to-decarbonize transportation modes and development of machine learning algorithms to detect land use change in high resolution imagery. The second addresses the role of critical minerals in energy storage materials. What is life cycle assessment missing in addressing the social and environmental effects of these minerals and how can it improve? The final example addresses approaches to reducing energy consumed in wastewater treatment while recovering important nutrients (nitrogen, phosphorous) that it contains. How do we know that these technologies will move the needle on energy consumption and greenhouse gas emissions in the water sector? Taken together, these examples highlight the potential of life cycle assessment but also some of its weaknesses and needs for further development.

Bio

Jennifer studies emerging technologies, their energy and environmental impacts, and their potential to influence greenhouse gas and air pollutant emissions, water consumption, and energy consumption. Technologies of interest include biofuels and bioproducts, automotive lithium-ion batteries, waste plastics recycling and utilization, advanced manufacturing, and fuels and chemicals made from natural gas liquids. Techno-economic, life cycle, and material flow analyses are primary tools in her research. Furthermore, she applies machine learning techniques to gain insights into land use and land use change, which drive the sustainability debate surrounding biofuels.

Jennifer holds a Ph.D. in Chemical Engineering from the University of Michigan where she was introduced to life cycle analysis through earning her Master's degree in Sustainable Chemical Engineering Systems. Her undergraduate degree in Chemical Engineering is from Purdue University. Prior to joining Northwestern, she led the Biofuels Analysis group at Argonne National Laboratory.