UNIVERSITY OF DELAWARE
DELAWARE ENERGY INSTITUTE

DEI WEBINAR

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12:30 PM

467 ISE LAB

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BIO

Dr. Abheek Chatterjee is a Postdoctoral Associate working with the Systems Integration Division at the National Institute of Standards and Technology. His research focuses on the use of complex systems, modeling, design and analysis approaches to support resilient and sustainable infrastructure development, with a special interest in the circular economy and clean energy transitions. At NIST, Abheek is investigating drivers, barriers, and impacts of circular economy initiatives – with a specific focus on Industrial Symbiosis. Abheek received his Ph.D. in Mechanical Engineering from Texas A&M University, where he researched the application of novel ecology-inspired design principles for the development of resilient and sustainable System of Systems, with applications to energy infrastructure, industrial networks, and supply chains. During his Ph.D., Abheek was a Graduate Teaching Fellow for the Texas A&M College of Engineering and a Texas A&M Energy Institute Graduate Fellow. Abheek is a recipient of the 2020 Systems Engineering, Information, and Knowledge Management Best Paper Award from the American Society of Mechanical Engineers.

INDUSTRIAL SYMBIOSIS: LEVERAGING INTER-FIRM PARTNERSHIPS FOR SUSTAINABLE DEVELOPMENT

TALK

Manufacturing and production operations are critical to the functioning of modern society – providing essential goods and services and supporting economic development. However, there are also significant environmental burdens connected to these processes such as increasing greenhouse gas emissions, increasing natural resource consumption, waste generation, and energy use. For instance, the manufacturing sector is estimated to be responsible for a fifth of the global carbon emissions, and global waste generation (and associated energy and resource consumption) are expected to double by 2060. Inspiration from biological ecosystems, which have evolved to maximize resource utilization and reduce waste, provides a promising solution to this conundrum – Industrial Symbiosis.

Industrial Symbiosis is the practice of building inter-firm partnerships, where the waste or byproduct of one firm can be used as raw material by another firm – promoting economic benefits for participating firms while reducing environmental impacts. The success of the Kalundborg Industrial Symbiosis, in Denmark, highlights the significant benefits of this approach. However, many Industrial Symbiosis initiatives fail in the early stages due to challenges such as the lack of knowledge regarding strategic network organization. Additionally, successful Industrial Symbiosis operations require the buy-in and adherence from multiple participating firms. In this presentation, I will discuss how we can quantify novel network design principles inspired by mutualistic biological ecosystems and the potential economic and environmental benefits of using such principles to design Industrial Symbiosis networks. I will also discuss the potential of network analysis metrics as benchmarks for Industrial Symbiosis development – without requiring sensitive firm information. The goal of developing such benchmarks is to enable comparison and knowledge transfer (regarding network organization) from mature Industrial Symbiosis networks to support the advancement of new Industrial Symbiosis networks. Finally, I will discuss how Industrial Symbiosis can enable sustainable clean energy waste management, promoting critical materials recovery.