Systems Analyses of Green Ammonia as a Sustainable Energy Carrier

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Green ammonia, which refers to ammonia produced from hydrogen obtained from water electrolysis and nitrogen obtained from air separation using renewable energy, has received tremendous attention in recent years due to its potential to decarbonize agriculture. In addition, green ammonia is being considered a sustainable energy carrier with promising applications in the energy and transportation sectors. Assessing the techno-economic viability of such technologies requires systems-level analysis and optimization at various scales. In this talk, we apply systems engineering tools to explore three ideas of how green ammonia can be used as an energy carrier: (i) Harness the strong wind on the open ocean by producing green ammonia directly offshore and subsequently shipping it to shore, which avoids the use of expensive submarine power cables for electricity transmission over long distances. (ii) Use mobile ammonia gensets for electricity generation as a non-wires alternative to improve reliability in power distribution systems. (iii) Use green ammonia as an alternative marine fuel to decarbonize the global shipping industry.

Bio: Qi Zhang is an Assistant Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota. He received his Ph.D. in Chemical Engineering from Carnegie Mellon University and worked at BASF prior to joining the University of Minnesota. His research in the area of process systems engineering focuses on mixed-integer optimization, decision making under uncertainty, and data analytics, with applications in sustainable process systems, smart manufacturing, supply chain management, and metabolic engineering. He is a recipient of the AIChE CAST W. David Smith Jr. Graduate Publication Award, the NSF CAREER Award, and the McKnight Land-Grant Professorship.