Engineering-level input-output modeling for low-carbon infrastructure planning

Topic: Using IO to Advance Investments in Efficiency, Resilience, and Sustainability
Author: Sangwon SUH

Avoiding the most dangerous consequences of climate change requires balancing anthropogenic greenhouse (GHG) emissions with natural sinks by the second half of this century. To do so, the global economy is expected to need 50-100 trillion USD infrastructure investments for low-carbon transition over the next a few decades. The types of infrastructure need to be addressed include energy (generation, transmission, and storage infrastructure), transportation (public transportation, road, and charging infrastructure), built environment (commercial and residential building infrastructure), and industrial production (manufacturing infrastructure). In this presentation, I will discuss a number of recent examples where engineering-level input-output data are used in an input-output framework to quantify carbon mitigation potential. First, the Green Technology Choice project by the international resource panel (IRP) examines over 60 low-carbon technologies in terms of their life-cycle GHG mitigation potential by integrating engineering- and sector-level input-output data with environmental extensions. The results show that both low-carbon energy supply and energy demand management technologies are needed for substantial GHG reductions. Second, The Weight of Cities project by IRP analyzes the impacts of deploying low-carbon infrastructure for bus rapid transit, district heating, green commercial building, and strategic densification of urban systems applied to over 84 global cities. The results show that GHG footprint of these cities would increase by 58%â€“116% by 2050. Low-carbon infrastructure and strategic densification, however, have the potential to curve down GHG emissions to 17% below the 2010 level in 2050. Finally, a series of articles by KÃ¤telhÃ¶n and colleagues examine chemical production processes and their GHG mitigation potentials using technology choice model, which is an engineering-level rectangular input-output model. These papers show that engineering data can be integrated into rectangular input-output structures for technology-choice questions. Toward the end of the presentation, I will discuss the benefits as well as the challenges in using engineering level data, and the synergies between the input-output and engineering communities working in the field of low-carbon transition.