

REMADE Institute – 2025 REMADE Circular Economy Tech Summit & Conference
Abstract Submission

Title of Paper: A physically extended EEIO framework for material efficiency assessment in United States manufacturing supply chains

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Primary Topic: Systems Analysis & Material Flows

Secondary Topic: Pathways to Net Zero Emissions in Manufacturing & Materials Production

Abstract:

A physical assessment of material flows in an economy (e.g., material flow quantification) can support the development of sustainable decarbonization and circularity strategies by providing the tangible physical context of industrial production quantities and supply chain relationships. However, completing a physical assessment is challenging due to the scarcity of high-quality raw data and poor harmonization across industry classification systems used in data reporting. Here we describe a new physical extension for the U.S. Department of Energy's (DOE's) EEIO for Industrial Decarbonization (EEIO-IDA) model, yielding an expanded EEIO model that is both physically *and* environmentally extended. In the model framework, the U.S. economy is divided into goods-producing and service-producing subsectors, and mass flows are quantified for each goods-producing subsector using a combination of trade data (e.g., UN Comtrade) and physical production data (e.g., U.S. Geological Survey). Given that primary-source production data are not available for all subsectors, price-imputation and mass-balance assumptions are developed and used to complete the physical flows dataset with high-quality estimations. The resulting dataset, when integrated with the EEIO-IDA tool, enables the quantification of environmental impact intensity metrics on a mass basis (e.g., CO₂eq/kg) for each industrial subsector. This work is designed to align with existing DOE frameworks and tools, including the EEIO-IDA tool, the DOE Industrial Decarbonization Roadmap (2022), and Pathways for U.S. Industrial Transformations study (2024).