software in python building on the Brightway framework — source code on Stew-McD/T-reX

T-ReX

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Simplifying footprint tracking for waste and materials in Life Cycle Assessment (LCA)

Context

(*) Developing the 'circular economy' relies on promoting 're-X' strategies (refuse, reduce, recycle, etc.,)

(*) The renewable energy transition requires supply chain resilience for critical raw materials (CRMs)

(*) Tracking waste generation and material consumption is essential, but these flows can be 'hidden' in supply chains

(*) Existing LCA methods attribute responsibility for impacts arising from consumption (such as methane or noise), but proper consideration of waste is lacking

(*) T-reX is an open source tool developed to enable the tracking of background waste and material inventories (footprints) in an automated, flexible and repeatable way

Methodology

Standard user project in brightway

Brightway

Standard LCA databases

ecoinvent

Incorporation of future models

premise

Flattening of databases into lists of flows

Analysis

Footprint Calculations

T-reX project in brightway

Mirroring as 'pseudo-biosphere' exchanges and creation of methods

Search and categorisation of relevant flows
(optional user-specific configuration)

Outcomes

(*) The user's brightway project and databases are manipulated to allow accounting of inventory footprints for waste production and material consumption

(*) Once the project has been processed with T-reX, the footprints can be efficiently and easily calculated in the same way as standard methods

(*) This contribution to the open source software ecosystem promotes a focus on re-X strategies in LCA by illuminating supply chain flows

(*) A simple case-study of five Li-ion battery supply chains is included to demonstrate the utility of T-reX to highlight 'hotspots'

(*) The case-study suggests that prospective databases over-represent future environmental impact mitigation through carbon capture and storage (CCS) while neglecting to implement potential changes in waste processing and resource recovery