Advancing absolute sustainability assessments of products with a new Planetary Boundaries based life-cycle impact assessment methodology - DTU Orbit (31/12/2018)

The Planetary Boundaries (PB)-framework introduced quantitative boundaries for a set of biophysical Earth System processes. The PBs delimit a ‘safe operating space’ for humanity to act within to keep Earth in a Holocene-like state (Rockström et al 2009). The concept has gained strong interest from companies that want to assess and communicate the environmental sustainability of their products relative to the PBs. However, consistent methods for assessing environmental impacts of products and systems based on the PBs have, to date, not been developed (Ryberg et al 2016).

In this study, we developed an operational life-cycle impact assessment (LCIA) methodology where the definition of the impact categories is based on the control variables as defined in the PB-framework by Steffen et al (2015). This included the development and calculation of characterization factors for the Earth System processes considered in the PB-framework. The characterization factors cover environmental flows contributing to impacts on the Earth System processes (e.g. CO2 and its precursors contributing to ocean acidification) and are expressed in the units of the PB framework’s control variables (e.g. change in the aragonite saturation state per unit CO2 emission for ocean acidification). The use of these characterization factors for evaluating the environmental impacts of products in LCA ensures impact scores that are compatible with the PB framework. The impact scores can be related to either the full PBs or an allocated safe operating space. The latter reflect the share of the safe operating space the assessed products can be considered entitled to, thereby, allowing for quantifying the absolute environmental sustainability of the products.

This new Planetary Boundaries based LCIA methodology provides additional and complementary insights which cannot be achieved with traditional LCIA methodologies. The key added value is the ability to relate the impacts of a product to the Planetary Boundaries. This can be used for communicating a product’s environmental performance and for setting reduction targets based on absolute environmental boundaries, thereby, advancing absolute sustainability assessments.

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