

TranZero: A Tool for Guiding the Transition to Resource Efficiency and Net-Zero Emissions

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In alignment with the Paris Agreement, nations have committed to limiting global temperature rise to below 1.5°C by reducing greenhouse gas emissions. The private sector plays a critical role in curbing Scope 1, 2, and 3 emissions, yet many companies have struggled to achieve their targets. We sought to address some of the challenges the private sector faces by developing a tool for guiding the **Transition** to resource efficiency and net-**Zero** emissions (*TranZero*). This tool is a user-friendly software designed to streamline decision-making and provide actionable pathways toward sustainability. The goal is to reduce stakeholders' hesitancy to act on sustainability initiatives caused by a lack of clarity and understanding of viable pathways.

A significant barrier to carbon neutrality is the high cost of alternatives. Carbon footprint assessments often fail to consider economic implications, making it difficult for companies to balance cost and emissions reduction. Furthermore, current pathways to carbon neutrality are typically siloed, neglecting other environmental goals such as waste reduction, circularity, and water conservation. This fragmented approach risks burden-shifting, where improvements in one area exacerbate impacts in another.

The complexity of these multi-objective challenges further complicates decision-making. Effective data visualization is essential but often inadequate. *TranZero* addresses these issues with an intuitive interface and advanced visualization capabilities, enabling decision-makers to navigate trade-offs clearly and confidently. By integrating techno-economic analysis, life cycle assessment, and multi-objective optimization, the tool identifies optimal solutions for achieving net-zero and circularity goals simultaneously.

One version of *TranZero* focuses on achieving a sustainable circular economy for multi-layer plastic barrier films. This version enables our industrial partner, Kohler, and other barrier film producers/consumers to identify the best technologies for achieving circularity and reducing emissions in a cost-effective manner. The tool evaluates and selects among reuse, recycling, and downcycling technologies to optimize end-of-life treatment for these films. The analysis identified the Solvent Targeted Recovery and Precipitation (STRAP) process as the most effective end-of-life technology in minimizing global warming potential. Notably, this process achieves its environmental benefits without significantly increasing costs. Furthermore, it demonstrates a high degree of material circularity, further enhancing its sustainability profile. By considering both environmental impacts and economic feasibility, *TranZero* helps companies to achieve circularity without compromising on emissions targets or financial goals.

Additionally, *TranZero* is being developed for a wide range of products and industries, including carbon fiber, polyesters, and the global chemicals and materials industry. Its generic and modularized design ensures adaptability for any product, company, or sector, making it a versatile tool for driving progress toward net-zero emissions in a cost-effective manner.