NREL
Transforming ENERGY

Materials Flows Through Industry Tool

As next-generation technologies gain traction and change the marketplace, they allow the U.S. manufacturing sector to steadily evolve. However, they may be more energy and emissions intensive than current technologies. That's why the National Renewable Energy Laboratory (NREL) developed the Materials Flows through Industry (MFI) tool to help manufacturers stay efficient and sustainable.

MFI is a supply chain modeling tool. It applies a mine-to-materials analysis to a wide range of manufacturing scenarios, identifying and analyzing opportunities to reduce the energy and carbon intensities of the U.S. manufacturing sector. The tool builds a network of every necessary step of production, resulting in a full supply chain that could contain hundreds of small material inputs and energy flows.

The tool was developed with support from the U.S. Department of Energy Advanced Manufacturing Office.

Insightful Supply Chain Modeling

To model a supply chain with the MFI tool, a user will:

- First select an end product and specify the production quantity
- Next, the manufacturing scenario for the supply chain is defined with two sets of parameters:
  - The technology mix used to produce end product
  - Sector efficiency potentials of selected production technologies.
- Finally, the baseline technology mix for each product reflects its current U.S. industry market share.. Technology mix parameters are also used to model changes in the electricity grid.

Three MFI Tool Options

Explore Recipes
Browse list of unit processes used in the MFI calculation engine.

Build New Scenarios
Create a new MFI scenario for a product of interest.

View or Re-Run Existing Scenarios
Browse list of scenarios to show, update, or delete.

Sector efficiency potentials capture increases in energy efficiency that would result from replacing current processing equipment with the most efficient equipment available. At baseline levels, all production technologies have zero energy efficiency increase, such that the scenario represents current energy efficiency levels in industry. Also, a user can choose to include or exclude the effects of industrial co-production, in which one production technology provides multiple useful products.

Impactful Data Visualization and Analysis

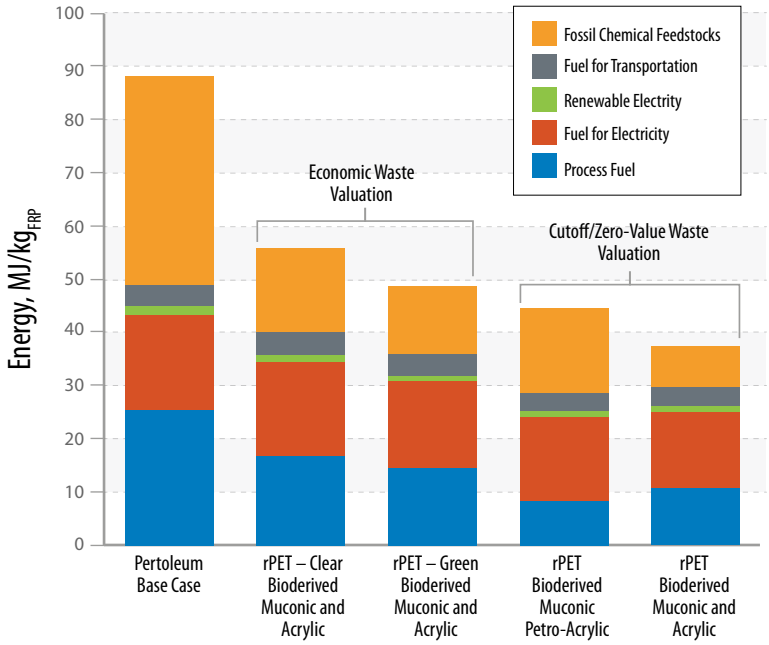
After a scenario runs, the MFI tool produces a downloadable Excel file with data tables and charts to help analyze the manufacturing supply chain. It even contains a brief explanation for each set of results to aid in user interpretation and further analysis.

For example, NREL researchers used the MFI tool to evaluate plastics upcycling with bioderived monomers. Upcycling is the ability to produce higher-value products from reclaimed material.

For all bioderived upcycling manufacturing scenarios, the MFI tool calculated a significant reduction in supply chain energy requirements. Potentially, it showed a 57% energy savings and a 40% reduction in greenhouse gas emissions compared to the conventional method of composite production.

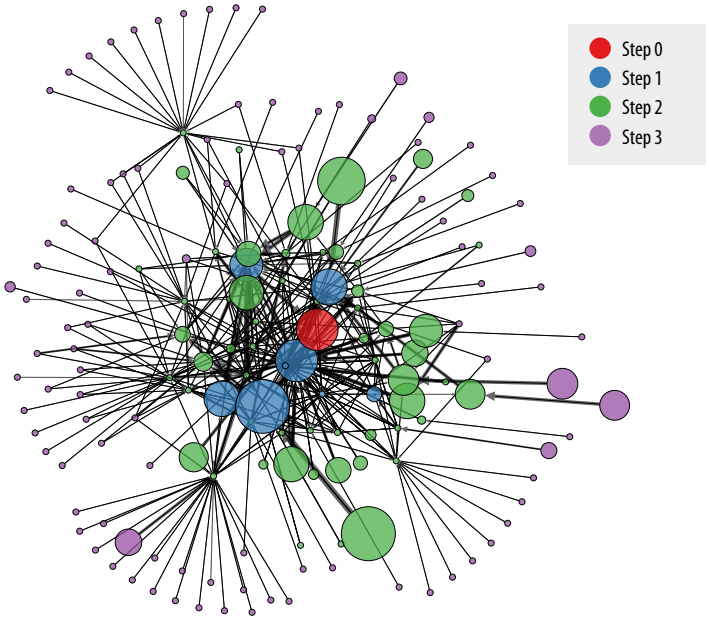
Get the FREE Tool

Visit www.mfitool.nrel.gov to request a free MFI tool account.



This is a sample chart produced by the MFI tool, which shows supply chain energy savings for bioderived plastics upcycling. *Source: Rorrer et al. (2019)*

Glass Fiber Reinforced Plastic Supply Chain Network



A visualization of how the MFI tool builds supply chain models starting with the final product (Step 0) and working backwards to determine required inputs.

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