



## Materials Flow Indicators Project

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In 1995, the World Resources Institute pioneered an international effort to formalize national accounts of material flows—material inputs and outputs—in industrial economies. Material flows analyses track the physical flows of natural resources through extraction, production, fabrication, use and recycling, and final disposal, accounting for losses along the way. The primary goal of the project is to demonstrate the value of materials flow data for creating indicators useful to formulating public policy.

Working with government agencies and organizations in the United States<sup>1</sup> and abroad,<sup>2</sup> WRI coordinated the effort to standardize a methodology for materials flow accounting. To date, the project has produced two reports that have shed considerable light on the trends in materials throughput over the last several decades and has already influenced the policy process in several European Union countries.

In late 2002, WRI embarked on a new phase of the project aimed at developing database standards and establishing protocols for collecting materials flow data. The purpose of this phase of the project is to further institutionalize the use of materials flow data and to support indicators of sustainable development. Sustainable development is largely defined by the indicators we choose to monitor and evaluate our progress. Data on the flow of materials in the economy form a critical subset of the information necessary for supporting indicators of national environmental, social, and economic performance, whether we are looking at pollutant releases in watersheds, carbon dioxide emissions into the atmosphere, or logs harvested from the forest.

The database formalizes flow characteristics for individual commodities and establishes relationships among flows to permit development of a wide range of sustainability indicators. Materials data are collected for industrial feedstocks from the five dominant resource sectors:

- energy,
- minerals,
- metals,
- forestry, and
- agriculture

To encompass the entire life-cycle of materials in the economy, data on materials generated during extraction and processing are included in the database, as are data on materials disposition after their use in the economy.

The materials flow database provides a single data source from which to develop multiple indicators of national well-being and thereby help to guide policy strategies for the future. The project has already produced macro-indicators that measure the decoupling of materials throughput from economic growth (i.e., dematerialization). In this next phase of the project, WRI plans to develop indicators of resource productivity that evaluate material utilization efficiency as well as the capacity to convert materials flow data into potential environmental impacts using science-based conversion factors. Over time, we expect that the data

will be used in unforeseen ways to assess current environmental performance and develop environmental policy options for the future. Suggested indicator categories include the following:

- **Macro Indicators of Material Flows:** total materials requirement, direct materials input, total domestic output, direct process output
- **Micro Indicators of Environmental Stress:** such as dissipation of heavy metals into the environment, land disruption resulting from materials extraction, atmospheric releases of greenhouse gases
- **Resource Efficiency Indicators:** recycling indices by economic sector, ratio of agricultural water consumption to food production, ratio of processed/raw materials

Beyond performance indicators the materials flow database offers a framework for building scenarios of shifting national consumption trends. For example, if electric cars were to gain broad market share, what would be the effect on materials used for mobile power sources? Would rising demand for electricity generation and batteries offset the benefits of reduced urban emissions? How has the American diet changed over time and what consequences has this had on materials consumption in agriculture? Does the switch from beef to poultry as a protein source translate to reductions in demand for animal feed and acreage tilled? What is the net effect of wholesale fuel switching? As wastes from coal mining and combustion diminish, how does the material requirement for noncarbon energy production respond?

The primary audience for this work includes government agencies, industry associations, and large firms concerned with natural resources extraction or processing. In addition, WRI expects that the database and indicators produced for the project will be useful to community organizations and researchers interested in using the materials flows framework for monitoring progress towards sustainability. As projected outcomes from this work, WRI aims to develop new policy initiatives thinking and management tools that help bring about the transition to more efficient and less environmentally harmful patterns of materials use in modern societies.

#### NOTES:

1. United States Environmental Protection Agency; US Geological Survey, Interagency Working Group on Sustainable Development Indicators; White House Council on Environmental Quality.
2. Swedish International Development Cooperation Agency; Statistical Office of the European Communities (EUROSTAT); Netherlands Ministry of Housing, Spatial Planning, and the Environment; Environment Agency of Japan; Global Environment Research Fund; Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management; Austrian Federal Ministry for Transport, Innovation, and Technology.

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