

Material flows

Material flow accounts record the total mass of natural resources and products that are used by the economy, either directly in the production and distribution of products and services, or indirectly through the movement of materials which are displaced in order for production to take place.

A material flow account balances the inputs (extraction of natural resources from the UK environment, and imports of goods) with the outputs (wastes, emissions to air and water, exports) and accumulation (in terms of new buildings etc) within the economy.

The direct inputs of materials into the economy derive primarily from domestic extraction, that is from biomass (agricultural harvest, timber, fish and animal grazing), fossil fuel extraction (such as coal, crude oil and natural gas) and mineral extraction (metal ores, industrial minerals such as pottery clay, and construction material such as crushed rock, sand and gravel).

The direct input of materials from domestic sources is supplemented by the imports of products, which may be of raw materials such as unprocessed agricultural products, but can also be semi-manufactured or finished products. In a similar way the UK exports raw materials, semi-manufactured and finished goods which can be viewed as inputs to the production and consumption of overseas economies.

Water is used so widely and in such quantities that its inclusion in the accounts tends to obscure other resource use. For this reason, the accounts only include the water that is contained in products (e.g. agricultural produce and imported beverages). Water for other consumptive uses (cleaning or irrigation) and in situ uses (such as hydroelectric power) is excluded from these accounts.

Hidden flows measure the quantity of material displaced by the process of extraction but not actually used in the production of goods and services. Indirect flows measure the quantity of material associated with the imports of raw and semi-processed goods into the UK. Both hidden and indirect flows are measured indirectly by applying coefficients for particular materials and goods to the estimated levels of mass associated with domestic and overseas extraction. Therefore, there is a direct relationship between hidden flows and actual extraction. Levels are sensitive to assumptions embodied in the particular hidden or indirect flow coefficient used. Examples of hidden flows are unused extraction from mining and quarrying (also known as overburden), discarded material from harvesting (e.g. wood harvesting losses such as timber felled but left in the forests) and soil and rock moved as a result of construction and dredging.

Summary aggregates

There are a number of indicators which can be used to summarise the flows of materials into and out of the economy. Material Flows show three of the main indicators used to measure inputs.

The **Direct Material Input (DMI)** measures the input of materials directly used by the economy, that is all materials that form part of products or are used in production and consumption activities. DMI equals used extraction in the UK (including that which is used or contained in exports) plus imports.

Domestic material consumption (DMC) measures the total amount of material directly consumed by the economy. It is the sum of domestic extraction and imports less exports

The **Total Material Requirement (TMR)** measures the total material basis of the economy, that is the total direct and indirect resource requirements of all the production and consumption activities. TMR includes the amount of used extraction in the UK, the imports into the UK and the resulting indirect or hidden flows associated with extraction in the UK and imports from other countries. Although TMR is widely favoured as a resource use indicator, the estimates of indirect flows are less reliable than those for materials directly used by the economy, and it can be argued that it double-counts trade flows, in that materials used both in the production of imports and in the production of exports are included. The indicator therefore needs to be considered alongside other indicators.

The **Physical Trade Balance (PTB)** measures the difference between the total mass of exports and the total mass of imports. This can be used to understand the international relationship of material use in the UK.

Sources and methods

Data on the yields of agriculture, forestry and fishing comes from the Food and Agriculture Organisation (FAO)¹.

Mineral extraction data has been taken from the *UK Minerals Yearbook*² and information on the mass of imports and exports has been taken from trade information compiled by HM Revenue and Customs³.

Factors applied to give estimates of the amounts of unused material moved for each tonne of used material have been taken from research carried out by the Wuppertal Institute on behalf of the Department for Environment, Food and Rural Affairs (Defra)⁴.

The methodology used to compile the account is also based upon the Wuppertal Institute's research.

1. Food and Agricultural Organisation (FAO), available at <http://apps.fao.org>

2. British Geological Survey (2005). *UK Minerals Yearbook 2005*

3. HM Revenue and Customs trade data, available at: www.uktradeinfo.com

4. Wuppertal Institute for Climate, Environment and Energy (2002). *Resource use and efficiency of the UK economy*.

See the Defra website at: <http://www.defra.gov.uk/environment/statistics/waste/research/mfa/index.htm>.