Canadian System of Environmental and Resource Accounts - Material and Energy Flow Accounts: Estimation

Energy

Reliable, quantitative estimates of annual energy use are available for the major energy-using industries directly from Statistics Canada surveys. Little more is required to incorporate these data into the MEFA than to aggregate them according to the MEFA classifications of industries and energy commodities. Ten energy commodities are represented in the accounts: coal, natural gas, liquid petroleum gases, electricity, coke, motor gasoline, diesel fuel, aviation fuel, light fuel oil and heavy fuel oil. Both the consumption of these commodities for their energy content (the combustion of gasoline in motor vehicles for example) and as material feedstocks (natural gas used as a raw material in fertiliser production for example) are measured in the accounts. The 10 energy commodities represented in the MEFA match exactly with those represented in the Input-Output Accounts. Moreover, the Report on Energy Supply-demand in Canada (Statistics Canada, Catalogue No. 57-003) provides benchmark estimates of total annual availability for each energy commodity.

In the case of energy consumers for which suitable quantitative data are not directly available, an alternative estimation method based on the Input-Output Accounts is used. The use of the Input-Output Accounts first requires that the available quantitative data be summed for each energy commodity. These amounts are then subtracted from total availability by commodity (from the Report on Energy Supply-demand in Canada), leaving a residual quantity of unallocated availability for each commodity. These residual quantities represent consumption by those consumers for which no direct quantitative data are available. The equivalent value of their energy consumption is calculated from the Input-Output Accounts by summing their energy purchases on a commodity-by-commodity basis. Dividing the value of purchases so calculated by the residual availability for each commodity yields an implicit unit price paid for energy by these consumers. This unit price, in turn, is used to estimate the quantity of energy consumed by each of these consumers by dividing their purchases by the unit price.

Water

Estimates of water use for major water-using industries are derived from industrial water use surveys (Statistics Canada). These surveys cover the mining industries, the manufacturing industries and the thermal electric power industry. Estimates for Oil and Gas Extraction were provided by the Canadian Association of Petroleum Producers.

Water-use estimates for the agriculture industry are prepared by combining data for livestock numbers and land-area under irrigation with water-use coefficients. Water use by households served by municipal water supply systems is available from Environment Canada's Municipal Water Use Database (MUD). Estimates are also made for the portion of the population not served by municipal systems by multiplying the number of persons by a per-capita water-use coefficient for self-supplied households.

The remaining, non-surveyed industries are estimated using the volume of water produced by drinking water plants in Canada and subtracting municipal water intake estimates for industrial use, the residential water intake estimate, and losses. These industries are grouped into a single category (Commercial and institutional), since there are insufficient data to distribute the total across the industries.

Greenhouse gases

Environment Canada's national inventory of greenhouse gas emissions is used as the basis for the estimation of the greenhouse gas emissions data (carbon dioxide, methane and nitrous oxide) included in the MEFA.

Emissions of carbon dioxide (CO_2) are the most straightforward of the greenhouse gases to measure. Emissions of this gas are primarily related to the combustion of fossil fuels. Environment Canada calculates a single set of emission factors that accurately express the quantity of carbon dioxide produced per unit of fossil fuel burned (in tonnes of CO_2 per terajoule of fuel). These factors are combined with MEFA energy data to estimate carbon dioxide emissions from fossil fuel. Emissions factors for non-combustion uses of fossil fuels (e.g., feedstocks) and industrial processes have also been developed to estimate their associated carbon dioxide emissions.

Estimates of the emissions of methane and nitrous oxides are also included in the MEFA, again based on the estimation methods developed by Environment Canada.

It is also possible to aggregate the emissions and express them as a single value with an index known as global warming potential (GWP). GWP measures the heat-trapping potential of each greenhouse gas. Carbon dioxide, the least effective of the gases at trapping heat, is arbitrarily assigned a GWP of one; other gases are assigned values in proportion to their heat-trapping potential relative to that of carbon dioxide (21 for methane and 310 for nitrous oxide). GWP is used in the MEFA to weight and aggregate emissions of carbon dioxide, methane and nitrous oxide. Aggregate greenhouse gas emissions for industries, households and governments are expressed in terms of “carbon dioxide equivalent” emissions.