Life cycle energy and chemical consumption in production and use of a 32MB memory chip

Eric D. Williams[†], Robert U. Ayres[††], and Miriam Heller[†††]

[†] United Nations University, 53-67 Jingumae 5-chome, Shibuya-ku, Tokyo, Japan
[††] INSEAD, Boulevard de Constance, Foutainebleau, 77305 Cedex, France
[†††]National Science Foundation, 4201 Wilson Blvd., Arlington, Virginia, 22230, USA

The scale of environmental impacts associated with the manufacture of microchips is characterized through analysis of material and energy inputs into processes in the production chain. The total weight of secondary fossil fuel and chemical inputs to produce and use a single 2-gram 32MB DRAM chip are estimated at 1,600 grams and 72 grams, respectively. Use of water and elemental gases (mainly N_2) in the fabrication stage are 32,000 and 700 grams per chip, respectively. Due to its extremely low-entropy, organized structure, the materials intensity of a microchip is orders of magnitude higher than that of "traditional" goods. Future analysis of semiconductor and other low entropy high-tech goods needs to include the use of secondary materials, especially for purification.