

The 1.7 Kilogram Microchip: Energy and Material Use in the Production of Semiconductor Devices

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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 N₂) in the fabrication stage are 32,000 and 700 grams per chip, respectively. The production chain yielding silicon wafers from quartz uses 160 times the energy required for typical silicon, indicating that purification to semiconductor grade materials is energy intensive. 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.

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