Comparison of the Impacts of the EPFL Computer Network using Process and Input-Output LCA

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The objective of this study was to assess the life cycle environmental impacts of the computer network of the Swiss Federal Institute of Technology in terms of the related primary energy consumption. The necessary equipment were assessed using two approaches to Life Cycle Assessment: Process Life Cycle Assessment (Process LCA) and Input Output Life Cycle Assessment (IO-LCA).

Both approaches show that the PCs (control units and screens) are dominating the system energy use. This is clearly because of the high number of PCs necessary for the computer network. The use phase plays a dominant role, but the embodied energy consumption during infrastructure production plays a significant role, increasingly important with the use of notebooks or flat screens. The results of the IO-LCA were a factor about 2 larger than the results of the Process LCA. The use phase does not show a very large difference. This is probably because the process LCA gives strong results for the primary energy related to the electricity consumption and the important contributions to the electricity sector might be easier to point out. On the other hand, the necessary energy for the production phase shows very large difference (factor 2 to 4.5). The main source of this difference is the larger number of inputs considered by the IO-LCA (e-g air transportation for PC which plays a significant role) together with the differences regarding the geographical and temporal sources of the data.

The importance of the personal computer necessitates a deeper analysis. Various studies show a factor 10 in the difference in the value of the embodied primary energy of one computer. On a per kg basis these studies show a good agreement about 200 MJ per kg of computer. The value obtained for the IO-LCA is just higher than 600 MJ per kg, the difference is a factor 3. Together with the uncertainty related to the average price and computer weight, the difference between the process LCA and the IO-LCA can be explained by:
1. the contribution not taken into account with the process LCA;
2. the luck of accuracy at the sector level;
3. the energy efficiency improvements between 1992 and 1997.
For example, the contribution of the sectors like: air transportation, wholesale trade, automotive rental or hotels and lodging places are significant and not taken into account in the process LCA. However, more information on the process LCA study are needed if one want to point out more precisely the origin of the differences and improve its reliability.