The Transition from Desktop Computers to Tablets

A Model for Increasing Resource Efficiency?

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***Abstract*—Sales statistics of computing devices show that users are not replacing units one by one, but rather adding additional devices to their hardware portfolios. In this paper, the authors describe the outcomes of a first attempt to quantify the ecological implications of these changes in the use of the ICT hardware for computing services by using LCA and applying three different perspectives ranging from individual devices, a "model family" up to global sales data of desktop, laptop, and tablet computers. In particular, the paper addresses the question which effect predominates: the increase in efficiency induced by the emergence of new technologies or the growing energy consumption due to the increased number of devices combined with a higher utilization rate by individual users.**

***Index Terms*—Life Cycle Assessment, LCA, Resource Efficiency, Desktop Computer, Tablet**

The assessment covered the time period 2004 to 2016 and addressed ICT devices for private computer work typically used in these years. For the modelling of production, use and end-of-life treatment of the covered devices, inventory data from the database ecoinvent (version 3.01) were used. The impact assessment was done with ReCiPe, one of the most up-to-date LCIA methods currently available.

In the third part of the study, the evolution of the amount of ICT equipment globally sold was examined. Figure 1 shows the resulting development of the environmental impact per hour of use of this globally sold hardware mix. As it can be seen there, the mix of ICT devices (i.e., desktop, laptop, and tablet computers) sold results in a constant reduction of the environmental impacts per hour of use from 2004 to 2016.

However, statistical data show that the use of these devices is growing over time; hence, in a second scenario the daily environmental impact of the use of this sold ICT device mix was calculated, based on the evolution of the use time of mobile devices. The resulting – daily – impact is shown in Figure 2. And according to Figure 2 there is no more reduction over time at all; i.e. the use of smaller (less energy-consuming) devices is more than overcompensated by the combination of a growing number of devices and increasing usage time.

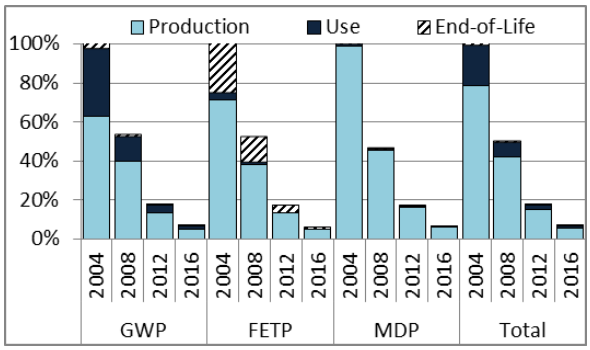

Figure 1: Environmental impacts of 1 hour of use of ICT devices for the mix sold in the various years. Shown are global warming potential (GWP), freshwater ecotoxicity potential (FETP), metal resource depletion (MDP), and the weighted total of all ReCiPe endpoint damage category.

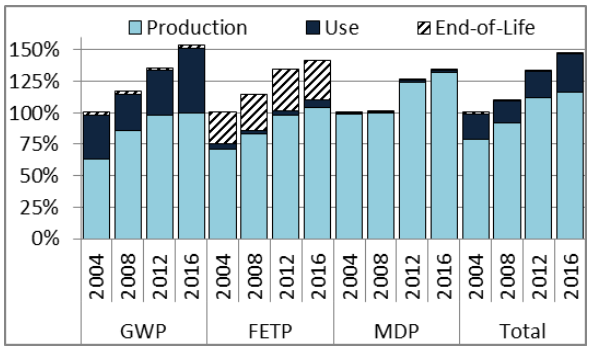

Figure 2: Daily environmental impact of use of ICT devices for the mix sold in the various years, assuming a growing daily use time (increase for mobile devices of 100% every 4 years)

All in all, the comparison of different "generations" of ICT hardware for private computing activities shows a clear reduction of the impact per hour of active use over time. However, as soon as the evolution in the use of such devices is taken into account as well, the picture changes.

This contribution is based on the book chapter of the same authors in Hilty LM & Aebischer B (Eds), ICT Innovations for Sustainability, Springer Series Advances in Intelligent Systems and Computing, 2014. The full text can be found in the book.