

NOKIA'S PRODUCT LIFE CYCLE ASSESSMENT OVER THE YEARS, INCLUDING CHALLENGES AND KEY FINDINGS

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ABSTRACT

Nokia has been continuously improving product life cycle assessments and keeping up to date with latest developments in methods and datasets to better evaluate their products. Because of the complexity of the products and long and complex supply chain, conducting product life cycle assessments is a very complicated task to begin with. There are factors that make the task even more challenging. Some of the biggest challenges faced along the way as well as key findings from Nokia's LCA studies are presented and demonstrated in this paper.

INTRODUCTION

Nokia has a long experience in conducting Life Cycle Assessments (LCAs) and has carried out environmental impact assessments since the middle of the 1990's. We have continuously improved our assessments, including methods and inventory data, to adapt them to better evaluate our products. Lately Nokia has piloted new methodologies as they have been developed and have become available. Recently Nokia has participated in the Directorate General for the Environment's (DG ENV) road testing of Product Environmental Footprint guide and also in the pilot test by Directorate General for Communications Networks, Content and Technology (DG Connect) to test the various methodologies to assess the energy consumption and greenhouse gas emissions of ICT.

LCA is an important tool as it gives a quantitative basis for measuring sustainability. At Nokia, LCA is used for example to calculate the environmental impact of products and activities and assessing and monitoring the environmental performance over time. The main goal of the method is to reduce the environmental impact by guiding the decision-making process. The results of the LCAs are used internally to help identify the key stages in the product life cycle, for example where the largest sources of emissions and energy use over the phone life cycle take place, and to take action to minimize these impacts.

Although externally Nokia only communicates climate change impact and energy use inventory data, other relevant impact categories are taken into account internally in decision-making to avoid burden shifting to other categories. Selecting the relevant impact categories for specific products needs to be done with enough knowledge and information to back the selection up. Calculating even just the greenhouse gas (GHG) emissions for our products requires extensive work and research due to the complexity of our products and long and

complex supply chains. Some of the biggest challenges and key findings from our LCA studies are presented and demonstrated in the following pages.

VARIATION IN RESULTS BASED ON ASSUMPTIONS AND CHOICES

We are constantly comparing and evaluating different databases, datasets, tools and methods to improve the accuracy of our calculations. Because of this, during the last few years the LCA figures for Nokia products have changed quite often. Based on all the work we have done with LCAs, we have found that no results are absolute and conducting LCAs is a continuous learning process due to the extent of available information and ongoing development in the LCA area.

One of the biggest challenges we have noticed while conducting our studies and participating in pilots is how many different factors affect the results. The impacts of assumptions, different LCA software tools, Life Cycle Impact Assessment (LCIA) methods, Life Cycle Inventory (LCI) databases and scenarios when assessing impacts on the product level all cause variations in the results. We use ISO 14040 and ISO 14044 standards that set the base and are complemented by the ICT specific ETSI TS 103 199 and ITU-T L.1410 that give ICT sector guidance (ETSI, 2011). Nonetheless, standards are just intended to set a framework for LCAs, allowing for many different kinds of studies, inherently allowing a lot of freedom. This allows large variations in results between studies performed by different practitioners and organizations independent of the used standard. Methods and impact categories are not completely unambiguous either, allowing different LCA software manufacturer to make some of their own choices when implementing these to their tools.

Results of climate change impact category for four different Nokia phones in 2010, 2011 and 2012 are presented in Figure 1. Phones themselves have not changed -- change in the figures comes from updates or changes in tools, data, assumptions or any of the other factors mentioned in the previous paragraph.

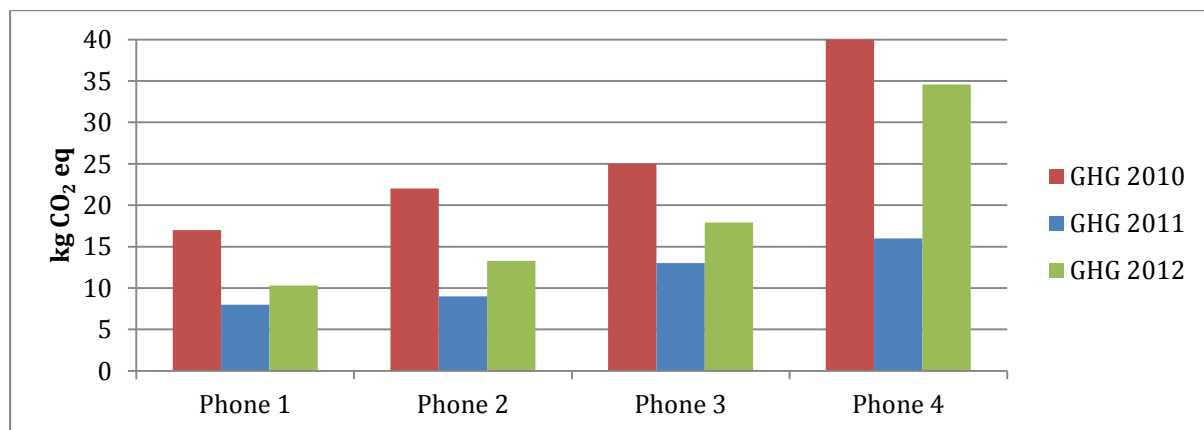


Figure 1. GHG emissions of four phones based on calculations made in 2010, 2011 and 2012.

A more specific example of change in figures can be given about ICs. Ecoinvent’s IC data was compared with PE International’s IC data by selecting the closest IC datasets in terms of silicon die area and other IC key parameters for the ICs in the N97 smart phone. From Ecoinvent v 2.2 datasets “IC, logic type, at plant/GLO” and “IC, memory type, at plant/GLO” were used, while from PE International data for ICs from electronics extension database was

used. Comparison was made on how large portion of GHG emissions from raw materials acquisition and component manufacturing is covered by ICs for N97 smart phone. ICs only covered 7% when using Ecoinvent’s data, while with PE International’s data the share became 28%. The reason is that datasets for the ICs in the Ecoinvent database, from year 2007, underestimate the size of the silicon die. In terms of ICs the differences between these two ICT specific datasets are unquestionable and so the LCA practitioner needs to have the competence to judge which dataset suits the studied functional unit the best.

Measurement and availability of representative data in general is an issue for the ICT sector because of the complexity and fast evolution of the sector and its supply chains, and this too may have a significant impact on the results of LCAs. Because of all of these observations, it is clear that there is inconsistency between impact figures across the industry, and these figures cannot be used for comparison between mobile devices from different manufacturers as also presented in the TENNG study. (TENNG, 2012)

DIFFERENCE BETWEEN MOBILE PHONES VS SMART PHONES

One important thing to tackle is also the comparability between different types of products (i.e. smart phones vs. mobile phones). Comparison to some extent is possible if the same person is making the assumptions and interpreting the standard and data to assess different types of products, but still there are challenges in this kind of comparison. The climate change impact of a basic mobile phone is quite small compared to the climate change of a smart phone. For example, for basic mobile phone Nokia 105 climate change equals 7 kg CO₂e, while for smart phone Lumia 720 climate change equals 21 kg CO₂e. However, these two products and what consumers can do with them differ significantly. Convergence of products should be somehow recognized especially with smart phones, but currently no methodologies define how to do this.

When using impact results to help identify the largest sources of emissions and take action to minimize these impacts, it is important to notice that the distribution of emissions between different life cycle stages is quite different in mobile phones versus smart phones, as can be seen in Figure 2 and Figure 3.

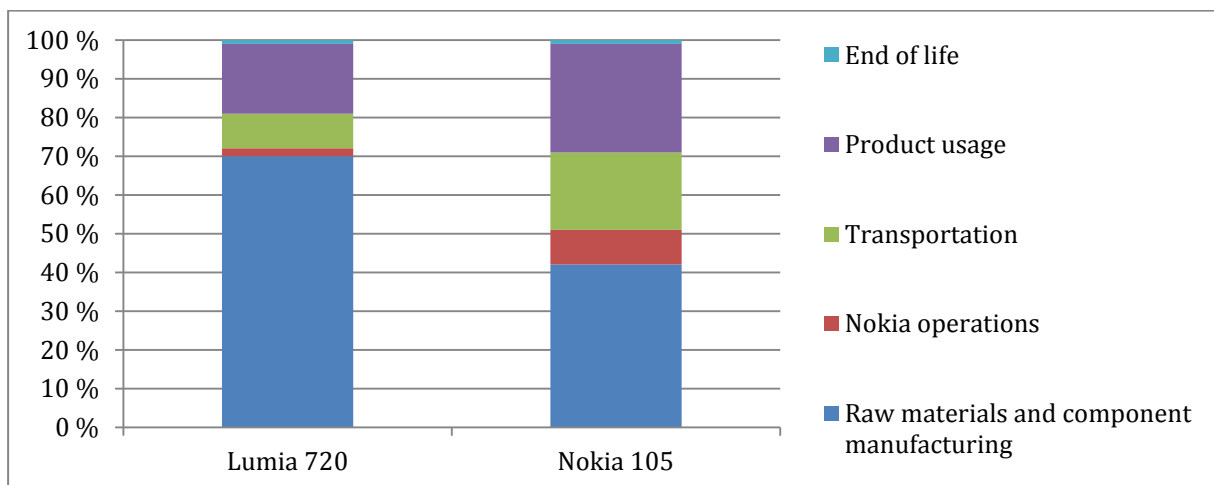


Figure 2. How GHG emissions are divided between different life cycle stages in two different types of products.

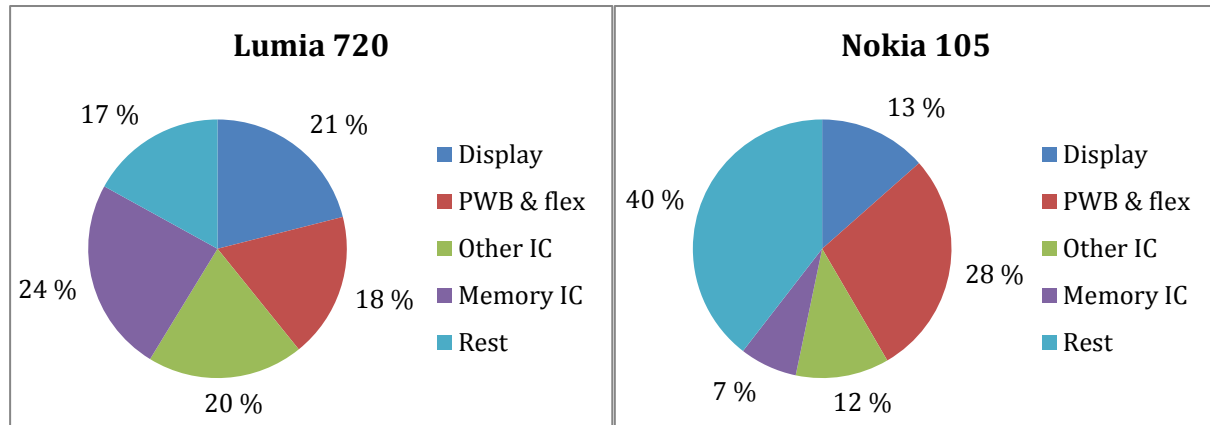


Figure 3. How GHG emissions of raw materials and component manufacturing are further divided between different components in two different types of products.

Furthermore, for example product use stage and the challenges of modeling it for LCA purposes are very different for these two phones. Determining typical consumer behavior for a device gets more and more difficult when the device is multifunctional as people tend to use their devices in very different ways. However, as use stage has a significant impact on overall results, it is not feasible to leave it out of the scope.

Another aspect that is not yet well supported by methodologies is the enabling effect of mobile phones. By identifying largest sources of emissions over the lifecycle companies are taking action in minimizing the environmental impact of products. However, this is just one side of the story as according to a GeSI report ICT sector has also the potential to reduce the impact of other industries, reduction potential being seven times the total direct emissions from the entire ICT sector in 2020 (BCG, 2012).

CONCLUSIONS

To be able to conduct an LCA for an ICT product, a lot of competence and knowledge about the sector specifics is needed together with in depth knowledge about LCA. Due to the characteristics of LCA, assessments of different producers are not comparable, as is presented in this paper. The life cycle based methodologies are well suited for high level policy purposes, such as identifying the key stages in a product's life cycle but are not suited for measures that impact fair competition between companies or market access due to required accuracy and associated uncertainty.

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