Life Cycle Assessment of Connectors

Accuracy Analysis of a Parameterised Model

Abstract

To reduce human impact on the environment it is important to detect the sources of emissions. PE INTERNATIONAL developed the software and database management tool GaBi to implement life cycle assessments (LCA) and analyse the impact of products.

The aim of this project was to analyse an existing parameterised model of electrical connectors. Connectors exist in each kind of electronic products but have most often a small contribution to the emissions of the whole product. Therefore the model was built up to implement LCAs for different types of connectors easily. For the application for different types of connectors the model simplifies the connectors and allows specification of only environmentally relevant aspects. With this study the quality of the model was analysed.

One connector in the model consists of the components plastic or metal housing, pins, electromagnetic interference shield (EMI-shield) and nuts, screws and washers from brass or steel. Connectors are further defined by mandatory and optional parameters.

Parameters for 39 different connectors were collected by disassembly and from datasheets. Scenarios for these connectors were set in GaBi. As result the global warming potential (GWP) in kg CO_2-equvivalencies was considered as main important impact category. Other impact categories are available in the model but have not been evaluated in detail.

Two groups of connectors were defined in the analysis: connectors with gold plated modules and connectors without gold plated modules. In the first group the gold plating causes 30.6 % to 97.8 % of the GWP of one connector. In the second group the GWP is proportional to the weight of the plastic housing.

For both groups a quality analysis was implemented. For connectors without gold plated components it was conspicuous that the pin weight of connectors with circular hollow pins is calculated imprecise by the model. The geometry of these pins is difficult to measure or to assume from drawings. If the pins are entered as flat rectangular pins, the calculation worked better. This comparison of the real weight and the calculated weight was only possible for disassembled connectors. The imprecise calculation applies to connectors with gold plated modules as well but because of the gold plating it is less obvious in the results. Another quality check set only mandatory parameters of two connectors without gold. With mandatory parameters the GWP was higher than with all applicable optional

parameters. In this case a nut and a washer from steel were neglected by the mandatory parameters and their weight was added to the plastic housing, which has a higher GWP than steel. This can be understood being ISO14040/44 conform, because a worst case is assumed by the model if less information is available.

In case of connectors with gold plated modules the scenarios with only mandatory parameters have much lower results for GWP, because the plating is neglected. As mentioned above the gold plating causes 30.6 % to 97.8 % of the GWP, therefore without plating the result contains only approximately 2.2 % to 60.4 % of the real emission of the connectors. The effect of neglected screws, nuts and washers is the same like for connectors without gold.

Concluding, the model is a good tool to include connectors in LCAs of electronic products with reduced effort. To improve the model the plating should belong to the mandatory parameters at least if it is gold plating. And the calculation of circular hollow pins should be revised, if pins contribute significant to the overall LCA result of the connector under consideration. To summarise the results of the study, two important parameters are obvious: the weight of plastic and the amount of gold.