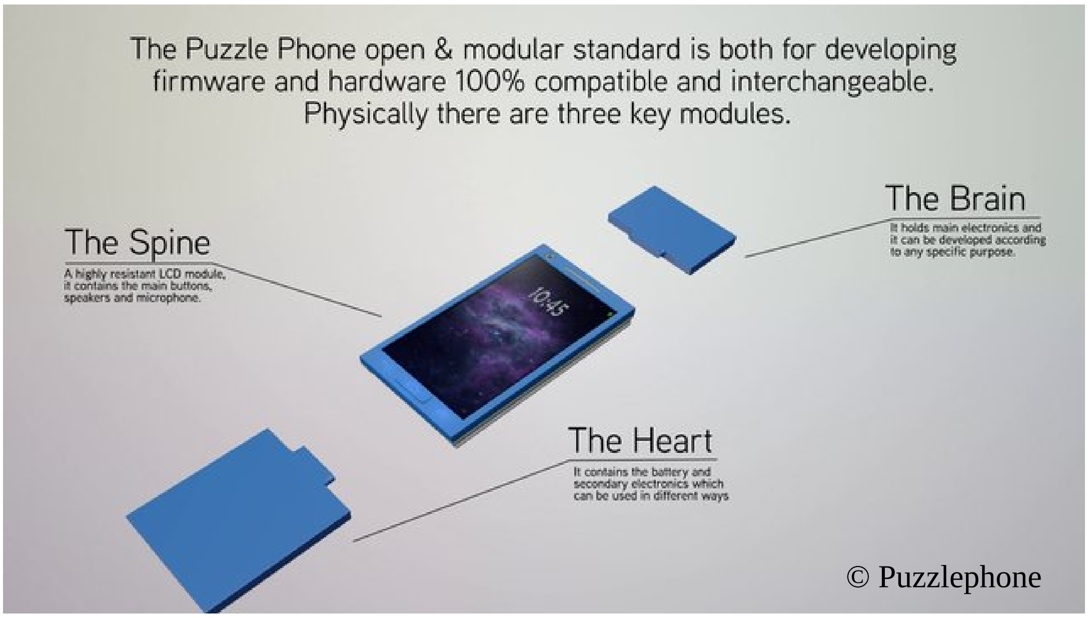
Smartphones
Case study
Puzzlephone

LCA to go



Aiming high, the Finland-based Puzzlephone team is attempting nothing less than the refashioning of common smartphone development and production routines. Since January 2013 the small but ever growing Puzzlephone team surrounding Alejandro Santacreu has been developing ideas and concepts to promote the approach to modular smartphones. “Reliable, repairable, upgradable” are the ultimate claims to be fulfilled by the Puzzlephone.

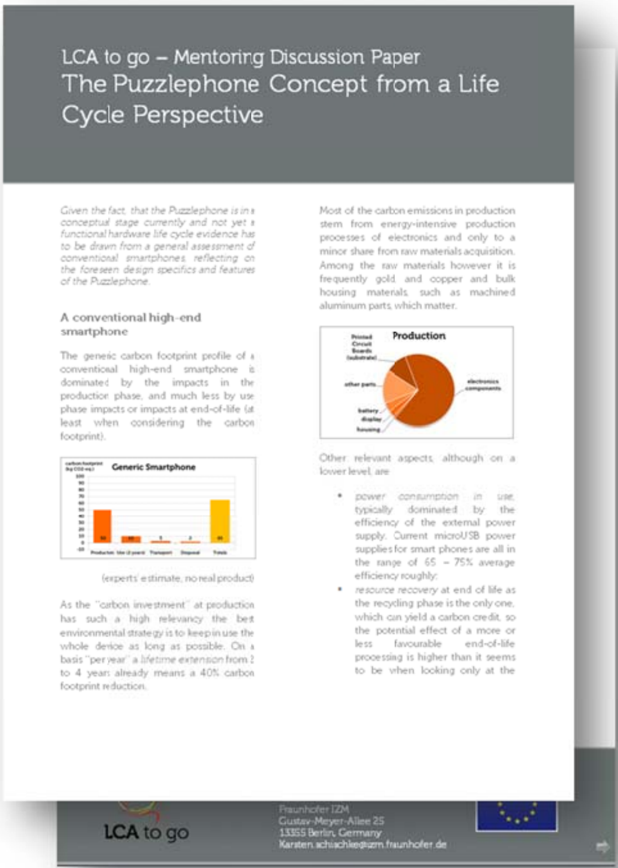
Puzzlephone’s smartphone concept features a standard electronic interface as the linking component of three modules. Creating the Puzzlephone platform as an open standard will enable different manufacturers to produce modules with completely different specifications. This will increase customizability along with reparability and through an increased lifetime the smartphone will have a decreased environmental impact. A broken module easily can be replaced individually.

As the Puzzlephone platform is still in its early stages of development, ecodesign as well as life cycle thinking can be implemented with maximum beneficial impact. The LCA to go mentoring programme can positively influence Puzzlephone’s development, but is challenged by the fact, that no real product is existing yet, and any environmental assessments have to be of theoretical nature.

Through LCA to go’s data on generic smartphone eco-profiles Puzzlephone’s potential life cycle hot spots were identified. Following Puzzlephone’s principle “trust begins with acts” Fraunhofer has offered basic advice on ecodesign measures.

Through a number of bilateral sessions and a comprehensive discussion paper drafted by Fraunhofer and commented on by Puzzlephone's Alejandro Santacreu some major design issues of the Puzzlephone concept where tackeled, which will also guide the future process of actually translating the Puzzlephone idea into a real-world product: Implementing design measures that will result in an overall extended lifetime of the smartphone is very important to the Puzzlephone concept. Keeping in mind robustness while at the same time optimizing recyclability and extending battery lifetime through improved thermal management yet without the extensive usage of metals for heat dissipation is a challenge the Puzzlephone platform will have to face on its way to the lowest possible environmental impact. Trade-offs between battery size and size of electronics is another issue. Having in mind the likely end-of-life routes for each of the three distinct components of the Puzzlephone helps to choose easily recyclable material combinations. These are just some of the aspects, which have been adressed based on insights in environmental issues.

The LCA to go mentoring facilitated the exchange between the Puzzlephone team and Fraunhofer on environmental engineering issues and is seen also as a strong asset to ramp-up production of the phone later on.


LCA to go – Mentoring Discussion Paper
The Puzzlephone Concept from a Life Cycle Perspective

Given the fact, that the Puzzlephone is in a conceptual stage currently and not yet a functional hardware life cycle evidence has to be drawn from a general assessment of conventional smartphones, reflecting on the foreseen design specifics and features of the Puzzlephone.

A conventional high-end smartphone

The generic carbon footprint profile of a conventional high-end smartphone is dominated by the impacts in the production phase, and much less by use phase impacts or impacts at end-of-life (at least when considering the carbon footprint).

(experts' estimate, no real product)

As the "carbon investment" at production has such a high relevancy the best environmental strategy is to keep in use the whole device as long as possible. On a basis "per year" a *lifetime extension* from 2 to 4 years already means a 40% carbon footprint reduction.

Most of the carbon emissions in production stem from energy-intensive production processes of electronics and only to a minor share from raw materials acquisition. Among the raw materials however it is frequently gold and copper and bulk housing materials, such as machined aluminum parts, which matter.

Other relevant aspects, although on a lower level, are

- *power consumption in use*, typically dominated by the efficiency of the external power supply. Current microUSB power supplies for smart phones are all in the range of 65 – 75% average efficiency roughly;
- *resource recovery* at end of life as the recycling phase is the only one, which can yield a carbon credit, so the potential effect of a more or less favourable end-of-life processing is higher than it seems to be when looking only at the

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