Carbon Footprint of the Dell Streak Tablet

Total greenhouse gas emissions for the Dell Streak tablet (45 kg CO_2eq) are comparable to those for 32 liters of orange juice.

Markus Stutz, EMEA Environmental Affairs Manager
April 2011

Dell recognizes that climate change is real and must be mitigated, and we support efforts to reduce global greenhouse gas (GHG) emissions to levels guided by evolving science. We are also committed to reducing GHG emissions beyond our own operations.

To do this, we have adopted a strategy that takes into account the GHG impacts of our products and our suppliers. We look at each stage of the product life cycle — from developing, designing and sourcing through manufacturing and operations, order fulfilment, customer use and product recovery.

By assessing the carbon footprint of a tablet, we are able to identify areas for improvement to reduce overall GHG emissions and also help customers do the same.

Calculating the carbon footprint of a tablet

In research conducted in 2010, Dell determined the carbon footprint of the Dell Streak tablet. It is the first Dell tablet and with a 5" display represents a hybrid of a smartphone and a tablet.

Figure 1: Dell Streak tablet.

The carbon footprint of the tablet was assessed for two regions: the US and Europe. This was done to compare the impacts caused by different transport patterns and energy mixes. Additionally, improvement options were assessed.

The GHG emissions were calculated according to ISO 14040 and ISO 14044, the two international standards governing the investigation and evaluation of the environmental impacts of a given product over its life cycle. The carbon footprint includes GHG emissions' contribution to global warming in kg of CO_2 equivalents (kg CO_2eq). We relied on the carbon footprinting expertise of PE International and on its GaBi database and tool for these calculations.

The following life-cycle phases were taken into account:

Manufacturing: Includes the extraction, production and transport of raw materials, the manufacturing of components and subassemblies (including product packaging), and the final

assembly of the tablet. As the subassemblies are manufactured around the final assembly site, transport to assembly was assumed negligible. Energy consumption (electric power, fuels, thermal energy) for the final assembly site in China was also included.

Transport: Includes air and land transportation of the tablet and its packaging from the final assembly site in China to the end customer.

Use: Lifetime of the tablet was estimated at 2 years. This is consistent with general consumer use models.

It was assumed that the tablet is charged every night. In the two first hours the battery is actively charged. As soon as the battery has been fully charged, yet the tablet has not been removed, the charger enters the "maintenance no-load" cycle. In this cycle a small level of discharging takes place, which is then recharged. After 10 hours the tablet is removed for its daily use, while the charger stays connected to the grid. In this "no-load" cycle, minimal energy consumption occurs due to the losses in the charger.

The use phase was considered in each of the two regions (US and Europe). The respective grid mixes were considered for each region.

Recycling: It is common for tablets to be refurbished and/or reused at the end of the first customer use. For this study, however, it was assumed that the tablet was sent for recycling at the end of the first customer use. Per European recycling legislation (the Waste Electronic and Electrical Equipment Directive, or WEEE) and similar US electronics recycling requirements, we assumed 75 percent of the tablet is recycled, while the rest is incinerated to recover the energy contained. Transport to recycling as well as energy used in mechanical separation and shredding were taken into account.

Carbon footprint of the Dell Streak tablet

The total carbon footprint of a Dell Streak tablet is approximately 45 kg CO_2eq when used in the US, and 42 kg CO_2eq when used in Europe. The main reason for the differences between the two scenarios is the amount of emissions associated with the differing power generation modes in the two regions, although variations in transport are also partly responsible.

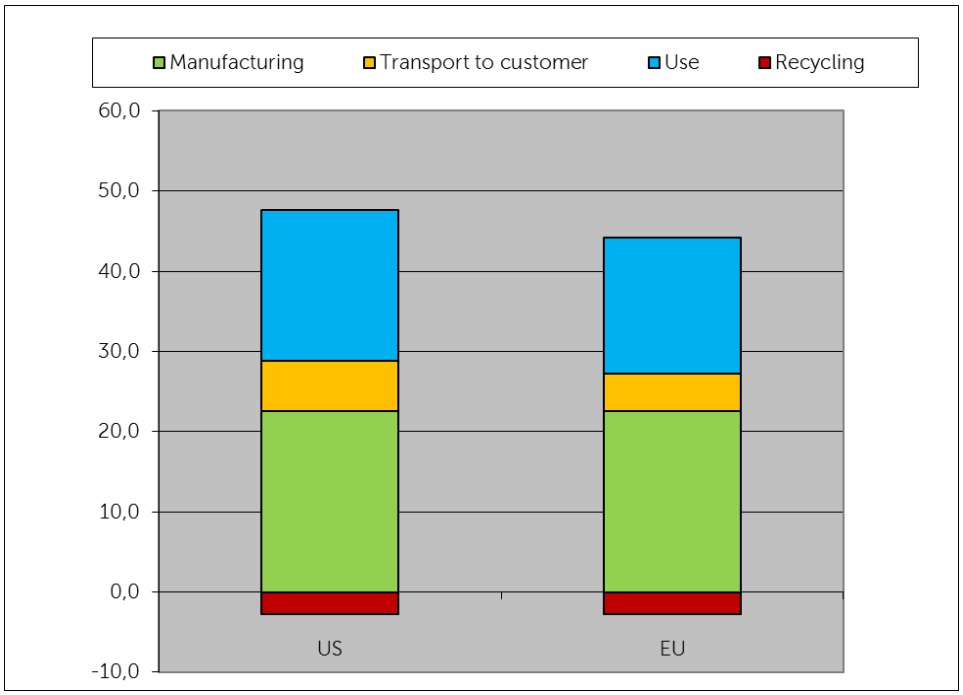

Figure 2: Total Product Carbon Footprint [kg CO2e] of the Dell Streak tablet in the US and Europe.

The GHG emissions from manufacturing (green) have the highest impact over the total life cycle, closely followed by the GHG emissions from use (blue). This distribution is consistent with other carbon-footprint research on mobile products such as mobile phones and laptops. In this case, the relative complexity of the tablet, its low power consumption and its relatively short lifetime are key factors. Also relevant is the fact that a lot of effort has gone into enhancing the energy efficiency of mobile products in general.

Transport to the customer (yellow) is relevant as well, as it includes air transport of the tablet to the regional distribution centers. The high impact of air transport is due to the fact that it is very energy intensive. In contrast, truck transport, which is used for final distribution, has a much lower impact. Ocean transport, which Dell is pursuing for many of its products, could reduce the total impact by approximately 14 percent.

Only two subassemblies make up about 85 percent of the total GHG emissions in manufacturing. These are the mainboard and the display. The mainboard accounts for about 28 percent of the tablet's total carbon footprint, while the display is responsible for 13 percent. Impacts of the mainboard are driven by the active components (semiconductors) and the substrate, which are both manufactured by highly energy intensive processes. In the case of the display, the driver is the electricity needed to manufacture the display panel.

The impact of the display strongly correlates with its size — i.e., a smaller display has a reduced impact, while a larger one generates increased GHG emissions. If a smartphone display of 3" is assumed, the total carbon footprint would be reduced to approximately 42 kg CO_2eq (a 7.5 percent reduction). Increasing the display size to an also common 7" would increase the total PCF to 53 kg CO_2eq (a 19 percent increase).

Taking into account the charging cycles as described above, the use phase is associated with approximately 41 percent of the total impact. A closer look (Figure 3) reveals that this impact is dominated by the "maintenance no-load" cycle (light blue), due to its relatively high energy consumption and the many hours spent in this cycle (10 hours). Active charging (grey) and "no-load" (orange) contribute far less, either due to the short time spent in the active charging cycle (2 hours) or to the very low energy consumption in "no load" (0.26 W).

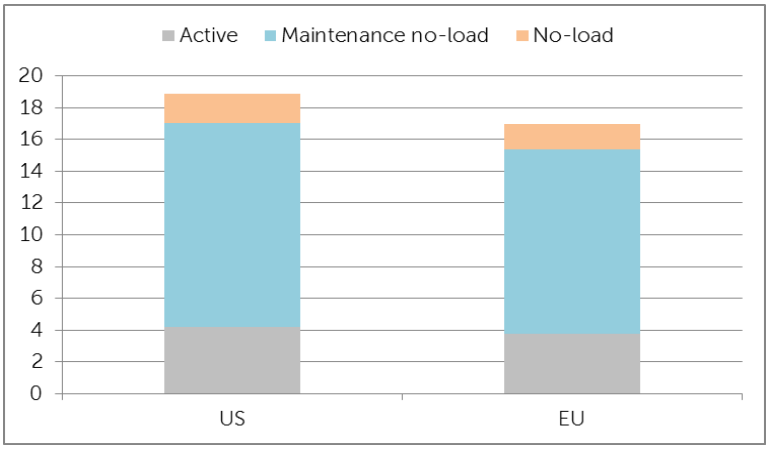

Figure 3: Carbon footprint contributions [kg CO2e] of the various charging cycles of the Dell Streak tablet in the US and Europe.

Reminding customers to unplug the tablet (and/or its charger) after it is fully charged has significant reduction potential, as it removes the "maintenance no-load" cycle completely. Around 32 percent of the total impact can be reduced by this simple measure, which can be further facilitated by making the tablet display an on-screen message or play an acoustic signal after the tablet is fully charged.

Lowering the energy consumption of the charger in "maintenance no-load" to a value observed in best-in-class servers (1 W) also has a significant reduction potential. Around 16 percent of the total impacts could be reduced this way.

The effect of unplugging charger when it is not charging the tablet (i.e., during the day) is surprisingly very low. This is due to the very low "no-load" energy consumption achieved in the past years.

As we assumed that 75 percent of the tablet is recycled, a credit (or a negative impact) of approximately 3 kg CO_2eq resulted. This is the case where the recycled (secondary) material can be used directly to replace the primary material in new products, thereby avoiding all GHG emissions associated with primary production of the material. Dell strives to encourage takeback and recycling of the tablet (and other Dell products) by offering free worldwide takeback for consumers.

The total product carbon footprint of the Dell Streak tablet is comparable to driving 150 km in a Porsche Cayenne (assuming a CO_2 emission of 296 g/km [1]). It is also comparable to drinking 32 liters of orange juice (assuming 360 g CO_2eq/250 ml [2]). For one person, that would equate to drinking an 8-ounce glass of orange juice every day for about four and a half months. This comparison demonstrates that the greenhouse gas emissions over a two-year lifespan of the tablet are very modest.

Acknowledgments

The author wishes to thank Dr. Constantin Herrmann, Alexandra Saraev and Flora Vadas from PE International for their support on this project.

References

[1] http://www.porsche.com/germany/models/cayenne/cayenne/featuresandspecs/ accessed 08.02.2010
[2] http://www.pcf-world-forum.org/2008/04/tesco-puts-carbon-reduction-label-on-20-products/ accessed 08.02.2010