Carbon Footprint of a Dell Latitude E5540

Puneet Shrivastava, Regulatory Senior Engineer, Environmental Affairs
Markus Stutz, Regulatory Principal Engineer, Environmental Affairs
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Total greenhouse gas emissions for the Latitude E5540 (311 $kgCO_2eq$) are comparable to those for filling up a VW Golf fuel tank nearly 2.5 times.

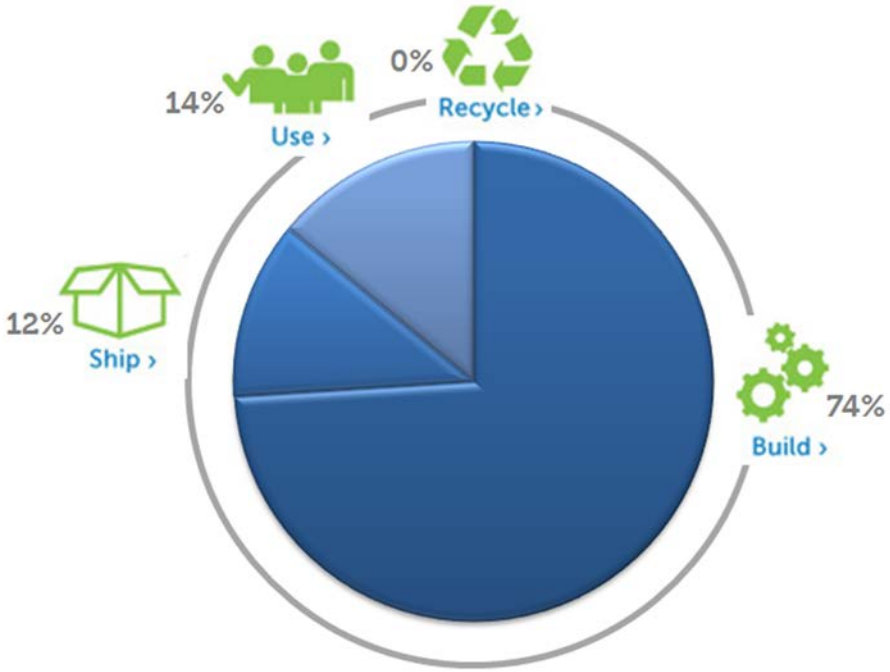

Figure 1: Breakdown of Contributions to Carbon Footprint

From product design to end-of-life recycling and everything in between, we consider the environment at every stage of a product's lifecycle. Our environmental programs and initiatives help Dell and our customers reduce consumption and minimize environmental impact.

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 laptop, 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 laptop

The carbon footprint includes GHG emissions' contribute to global warming in kg of CO_2 equivalent ($kgCO_2eq$). Dell uses PAIA (Product Attribute to Impact Algorithm) to perform product carbon footprints (PCFs) on current models of desktops and laptops. PAIA is a streamlined LCA tool developed by MIT's Materials System Laboratory that estimates carbon and energy impact. It takes into consideration important attributes of the product which can be correlated to activities such as manufacturing processes or transportation to calculate the product carbon footprint[1]. The life-cycles phases taken into account are Manufacturing, Transportation, Use, and Recycling. Assumptions made and information required for each phase are as follows:

Build: Manufacturing traditionally includes the extraction, production, and transport of raw materials, the manufacturing of components, and subassemblies (including the product packaging), the manufacturing of the product, and the final assembly of the laptop. These values can be derived from attribute information that is gathered from general dimensions, chassis and mechanics, hard drive, optical drive, power supply unit, motherboard and other boards, and packaging.

Ship: Transportation contributions include air, ocean, and land transportation of the laptop and its packaging from the product manufacturing location to the final assembly sites, and from there to the distribution centers. Transport of the laptop from distribution centers to the end customer was also included. Transport can be quite varied, depending on region, laptop customization level, and lead time.

Use: Lifetime of the laptop was estimated at 4 years. This is consistent with general business customer use models. It was assumed that the external power supply is connected to the electricity 24 hours a day, 365 days a year. To determine the energy consumption in use, the US Environmental Protection Agency's Energy Star® Typical Energy Consumption (TEC) method was used. This method focuses on the typical energy consumed while in normal operation during a representative period of time and can be used to compare the energy performance of computers. The use phase was considered in the US only.

Recycle: It is common for laptops to be refurbished and/or reused at the end of the first customer use. For this study, however, it was assumed that the laptop was sent for recycling

[1] MIT Materials System Laboratory: http://msl.mit.edu/projects/paia/main.html

at the end of the first customer use. Following US electronics recycling requirements, we assumed 75% of the laptop 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 Latitude E5540

The total carbon footprint of a Dell Latitude E5540 is approximately 311 $kgCO_2eq$ when used in the US.

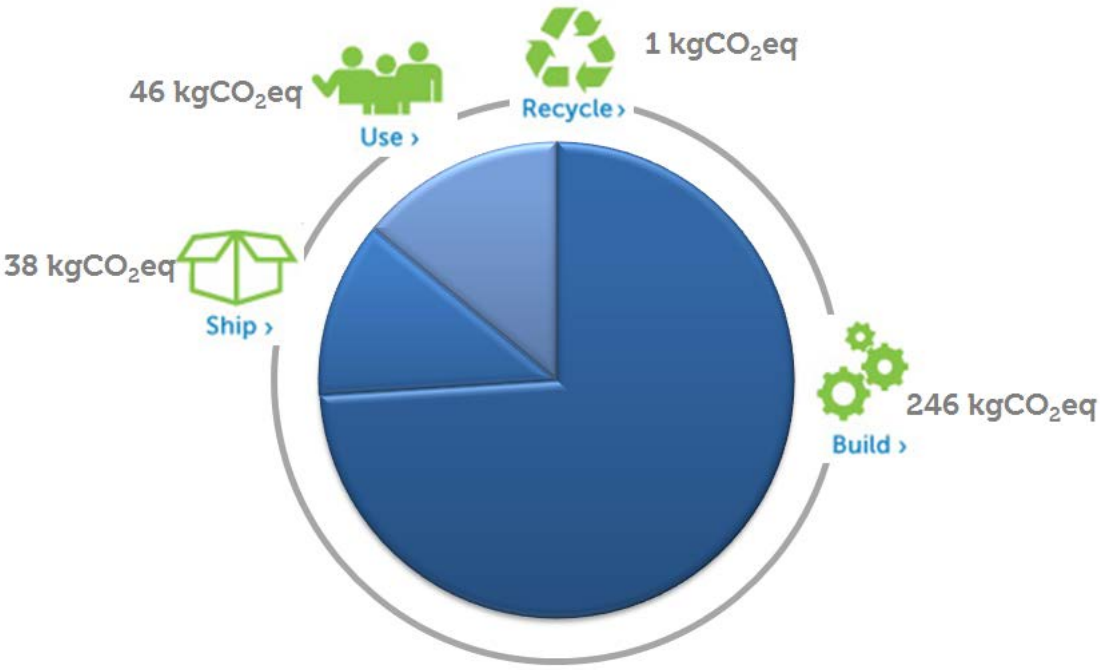

Figure 2: Total Product Carbon Footprint [$kgCO_2eq$] of the Latitude E5540 Laptop in the US.

The GHG emissions from manufacturing is roughly 3/4 of the total, with use and transportation making up the majority of the remaining 1/4. This distribution is consistent with other PAIA-modeled Latitudes. In this case, the relative complexity of the laptop, its low power consumption, and its relatively short lifetime are key factors. A lot of effort has gone into enhancing the energy efficiency of laptops. For most other computer equipment (e.g., desktop PCs and servers), the use phase is typically a much larger component.

Manufacturing contributes 246 $kgCO_2eq$ to the overall carbon footprint (74%) – The GHG emissions from manufacturing makes up almost 3/4 of the total emissions. This can be attributed to the steps taken to decrease the carbon input in the other phases. The majority of the emissions contributed to the manufacturing phase come from the materials and production of, in order of importance, the mainboard and other boards and the display.

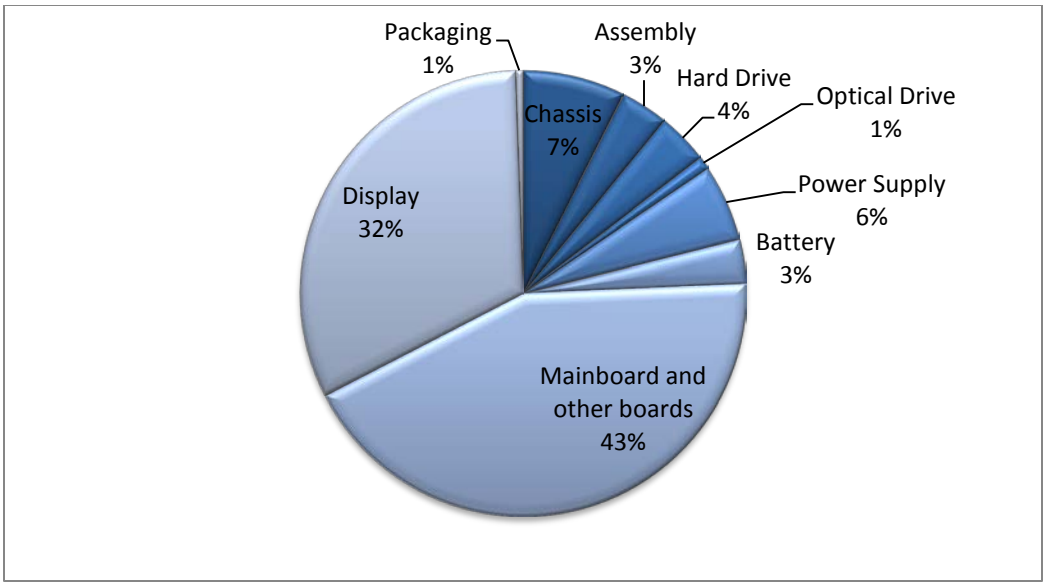

Figure 3: Breakdown of manufacturing phase in the carbon footprint. Total manufacturing contribution is 246 kgCO_2eq, or 74% of the total carbon footprint.

Transportation contributes 38 kgCO_2eq (12%). Currently, transporting products from the assembly location to the country of use relies on a large part on air transport, with a smaller portion being shipped via ocean. Within the country of use, Dell transports primarily by truck. Air transportation has a very high impact due to the fact that is very energy intensive. In contrast, truck and ship transport have much lower impact.

Use contributes 46 kgCO_2eq (14%). This product is Energy Star version 5.2 certified, which requires it to have several regulated power modes, including multiple idle stages, sleep, and off. Considering these modes and the average use of a laptop, a yearly TEC, or typical energy consumption, can be calculated. For the Latitude E5540 this is 15.39 kWh.

Recycling contributes 1 kgCO_2eq, which is not significant when compared to the other phases, and makes up 0% of the total emissions. PAIA uses the cut-off method for end-of-life. The impact of end of life is calculated, but recycling is not credited to offset the carbon footprint. However, a market mix of recycled metals is assumed on the front end (raw materials phase), so recycled content is taken into account upstream.

The total product carbon footprint is comparable to consuming 144 liters (38 gallons) of gas, enough to fill a VW Golf fuel tank nearly 2.5 times. This comparison demonstrates that the greenhouse gas emissions over a four-year lifespan of the laptop are relatively modest.

What is Dell doing to lower the carbon footprint?

By optimizing consumption of energy, we can reduce costs, shrink our carbon footprint and develop expertise that allows us to help our customers do the same.

Build: We committed in early 2009 to further reduce our worldwide facilities' GHG emissions by 40% by 2015. We require our primary suppliers to measure and publicly report their GHG emissions, and we ask them to set improvement goals of their own and set expectations for their suppliers.
We also continue to making smarter choices about the materials that go into our products by using environmentally preferable materials and avoiding those that are not.

Ship: With the introduction of "Smart Selection" systems, the vast majority of purchases will be premade models. These will ship via ocean and will change the transportation from the manufacturer to the customer from a 70% air–30% ship ratio to 20% air–80% ship or better.

Use: All Latitude laptops, OptiPlex desktops, and Precision workstation systems can be configured for Energy Star® compliance and are among the most energy-efficient in the industry. As of fiscal year 2013, we also offer approximately 200 products registered for Electronic Product Environmental Assessment Tool (EPEAT).
The use of power management features, which put the laptop into sleep mode when not used, needs to be applied by the users more uniformly. This is best achieved by leaving the power management in the factory-default setting.

Recycle: Dell's goal was to offer safe, responsible recycling solutions to all of our customers globally. We were the first in the industry to ban the export of non-working electronics and e-waste to developing countries and we work hard to develop convenient technology recycling programs available to communities worldwide. We have partnered with shipping companies to provide free mail-back recycling of Dell-branded electronics equipment.

Acknowledgements

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