

Carbon Footprint of a Typical Business Laptop From Dell

Total greenhouse gas emissions for the Latitude E6400 (350 kg CO₂eq) are comparable to those for 240 liters of orange juice.

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In 2007, the United Nations Intergovernmental Panel on Climate Change (IPCC) asserted in its fourth (and, as of this writing, most recent) assessment report that “continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century.” IPCC concluded that “developed countries, as a group, would need to reduce their emissions 10 to 40 percent below 1990 levels by 2020 and 40 to 95 percent below 1990 levels by 2050, even if developing countries make substantial reductions.”

Dell supports the scientific consensus on climate change — as evident in our commitment and actions. We support reducing greenhouse gas (GHG) emissions to levels guided by science and are actively focusing on energy efficiency, cleaner and renewable forms of electricity in our operations, and other ways to reduce our climate impact.

In addition to addressing our operations, we target the GHG emissions of our products over their entire life cycles: their manufacture, transport, use and disposition. 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

In research conducted in late 2009, Dell determined the carbon footprint of the Latitude E6400, a typical high-volume, mainstream business laptop that is representative of a range of similar laptop products. It is Energy Star® 5.0 qualified and EPEAT Gold registered.



Figure 1: Dell Latitude E6400 laptop.

The carbon footprint of the laptop was assessed for three regions: the US, Europe and China. This was done to compare the impacts caused by different transport patterns and energy mixes.

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 their life cycle. The carbon footprint includes GHG emissions' contribution to global warming in kg of CO₂ equivalents (or kg CO₂eq). 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), the manufacturing of the product, and the final assembly of the laptop. The transport of the five heaviest subassemblies (battery, chassis, hard drive, display and motherboard) was taken into account as well. Energy consumption (electric power, fuels, thermal energy) for different Dell final assembly sites (Malaysia, Poland and China) was also included.

Transport: Includes 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 in the three regions. 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 supply 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 electricity 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 each of the three regions (US, Europe, and China). The respective grid mixes were considered for each region.

Recycling: 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 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 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 E6400 laptop

The total carbon footprint of a Dell Latitude E6400 is approximately 350 kg CO₂eq when used in the US. The results differ from region to region, but not by much. The carbon footprint of the same laptop used in Europe is about 320 kg CO₂eq; in China, approximately 370 kg CO₂eq. The differences are due to the variations in GHG emissions from differing power generation modes in the three regions.

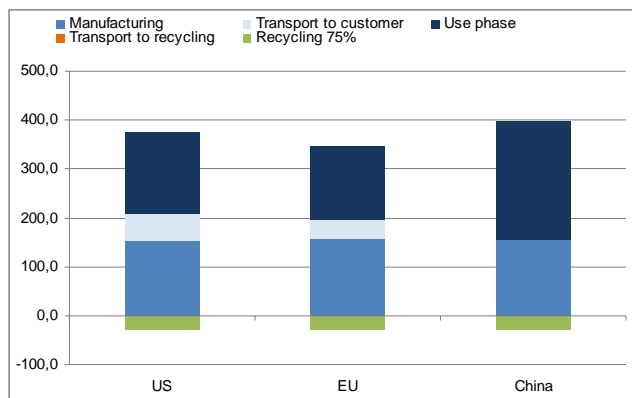


Figure 2: Total Product Carbon Footprint [kg CO₂e] of the Latitude E6400 laptop in the US, Europe, and China.

The GHG emissions from use (dark blue) and from manufacturing (blue) are roughly equal. This distribution is consistent with other carbon-footprint research on mobile products. In this case, the relative complexity of the laptop, 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. For most other computer equipment (e.g., desktop PCs and servers), typically the use phase dominates the carbon footprint.

A handful of subassemblies make up about 95 percent of the total GHG emissions in manufacturing. These are, in order of importance, the motherboard, the display, the chassis and the battery. The motherboard alone accounts for more than 20 percent of the laptop's total carbon footprint.

Transport to the customer is particularly relevant where it includes air transport. This is the case for the US and Europe, where the laptop is often transported by plane 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 China, has a much lower impact. The impacts are therefore also low for the final distribution by truck to the customer from the distribution centers.

As we assumed that 75 percent of the laptop is recycled, a credit (or a negative impact) of approximately 30 kg CO₂eq 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.

The total product carbon footprint of the E6400 laptop is comparable to driving 1,200 km in a Porsche Cayenne (assuming a CO₂ emission of 296 g/km [1]) or drinking 240 l of orange juice (assuming 360 g CO₂eq/250 ml [2]). This comparison demonstrates that the greenhouse gas emissions over a four-year lifespan of the laptop are relatively modest.



Figure 3: A display showing the carbon footprint of orange juice in a UK supermarket.

What Dell is 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.

Manufacturing: In 2008, we met our operational carbon neutrality goals for our global operations ahead of schedule. 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.

Use: Dell makes available a broad range of Energy Star® products. In 2008 alone, Dell offered 14 Energy Star® desktop configurations and 14 Energy Star® notebook systems, including four mobile workstations and one consumer system.

Recycling: Dell is committed to the environmentally responsible reuse and recycling of our products when our customers are finished with them. We are the first manufacturer to offer free computer recycling to consumers worldwide, and we have been providing responsible recycling services for more than a decade. We were also the first major computer manufacturer to ban the export of e-waste to developing nations.

Acknowledgments

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References

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- [2] <http://www.pcf-world-forum.org/2008/04/tesco-puts-carbon-reduction-label-on-20-products/> accessed 08.02.2010