Carbon Footprint of a Typical Business Desktop From Dell

Total greenhouse gas emissions for the OptiPlex 780 Mini Tower (800 kg CO_2eq) are comparable to those for 560 liters of orange juice.

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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 desktop, 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 desktop

In research conducted in 2010, Dell determined the carbon footprint of the OptiPlex 780 Mini Tower, a typical high-volume, mainstream business desktop that is representative of a range of similar desktop products. It is Energy Star® 5.0 compliant and EPEAT Gold registered.

Figure 1: Dell OptiPlex 780 desktops; Mini Tower is at far left.

The carbon footprint of the desktop was assessed for three regions: the US, Europe and Australia. This was done to compare the impacts caused by different assembly and 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 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 desktop. The transport of the subassemblies (chassis, hard disc drive (HDD), optical disc drive (ODD), motherboard, cables,

power supply unit and packaging) was taken into account as well. Energy consumption (electric power, fuels, thermal energy) for different Dell final assembly sites (US, Poland and China) was also included.

Transport: Includes air, ocean and land transportation of the desktop and its packaging from the final assembly sites in the three regions to the end customer. Transport can be quite varied, depending on region, desktop customization level and lead time.

Use: Lifetime of the desktop was estimated at 4 years. This is consistent with general business customer use models. 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 Australia). The respective grid mixes were considered for each region.

Recycling: It is common for desktops to be refurbished and/or reused at the end of the first customer use. For this study, however, it was assumed that the desktop 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 desktop 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 OptiPlex 780 Mini Tower

The total carbon footprint of a Dell OptiPlex 780 Mini Tower is approximately 800kg CO_2eq when used in the US, 720kg CO_2eq when used in Europe and 1230kg CO_2eq when used in Australia. The main reason for the differences between the three scenarios is the amount of emissions associated with the differing power generation modes in the three regions, although transports in the assembly and distribution chain also account for a significant part of the differences.

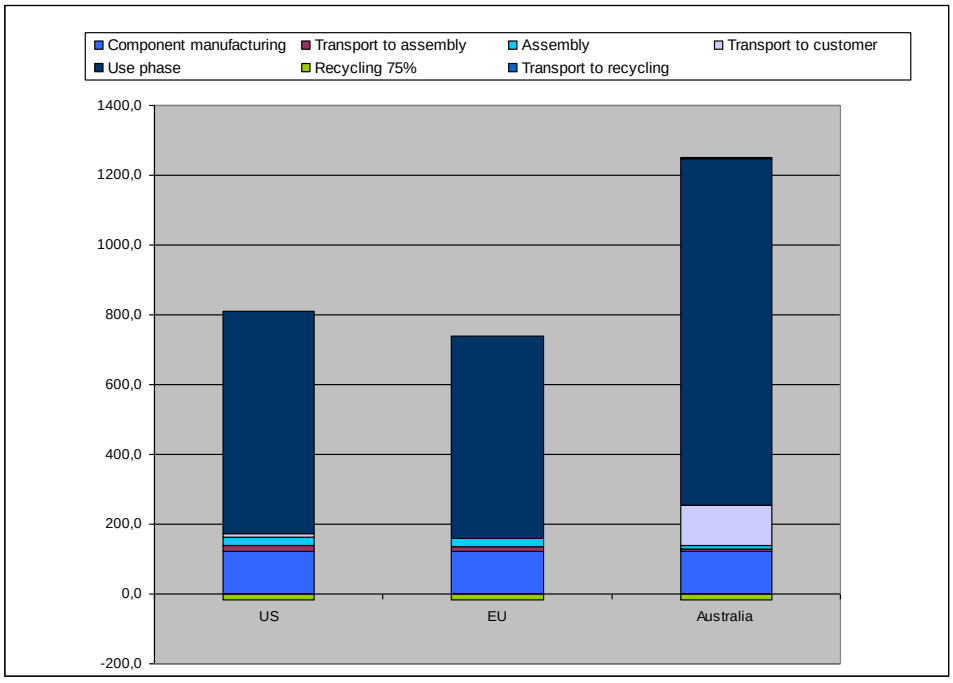

Figure 2: Total Product Carbon Footprint [kg CO2e] of the OptiPlex 780 Mini Tower in the US, Europe and Australia.

The GHG emissions from use (dark blue) account for approximately 80 percent of the total life-cycle impact. This dominance of the use phase can also be observed in other electronic equipment. It demonstrates that our goal to design laptops and desktops to consume up to 25 percent less energy by end of calendar year 2010 compared with systems offered in May 2008 is right on target.

Additionally it makes the case that use of power management features, which put the desktop 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.

Manufacturing — which includes component manufacturing, transport of components to assembly and assembly itself — has the next biggest impact, but it still represents only a fraction of the total GHG emissions (10 to 20 percent, depending on the scenario). Only three subassemblies make up about 85 percent of the total GHG emissions in manufacturing. These are, in order of importance, the motherboard, the chassis and the ODD. The motherboard accounts for about 8 percent of the desktop's total carbon footprint.

Transport to the final assembly and to the customer is not particularly relevant where it includes transport by ship or by truck. This is the case for the US and the European scenario, where subassemblies, with the exception of the HDD and the ODD, are transported by ship and truck to the regional final assembly sites (Winston-Salem, NC, and Lodz, Poland, respectively). A different picture emerges in the Australian scenario, where the desktop is assembled in China and then transported by plane to the regional distribution center. Air travel, given the same distance and same amount of transport goods, has a carbon footprint that is about 42 times higher than road travel and about 164 times higher than transport by ship. Regional assembly or transport by ship, if lead time allows, is therefore a very preferable option from a GHG emissions point of view.

As we assumed that 75 percent of the desktop is recycled, a credit (or a negative impact) of approximately 20kg 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.

The total product carbon footprint of the OptiPlex 780 MT is comparable to driving 2,700km in a Porsche Cayenne (assuming a CO_2 emission of 296g/km[1]). It is also comparable to drinking 560 liters of orange juice (assuming 360g CO_2eq/250ml[2]). This is equivalent to each member of a family of four drinking 390 ml (13 fluid ounces) of orange juice every day for a year. These comparisons demonstrate that the GHG emissions over a four-year lifespan of the desktop are relatively modest.

Comparison of the carbon footprint of a laptop

Earlier in 2010 Dell published a carbon footprint study of a typical business laptop, the E6400[3]. The laptop and the desktop are products designed with a basic set of overlapping functionalities (computing), but a larger set of differences due to the different requirements (e.g., mobility versus storage). The results of the two studies show that a laptop has an inherently lower carbon footprint due to the high efficiency in use.

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: All Latitude, Precision and OptiPlex systems can be configured for Energy Star® 5.0 compliance and are among the most energy-efficient in the industry. In fiscal year 2010, we had more than 135 products registered for Electronic Product Environmental Assessment Tool (EPEAT).

Dell implemented server-managed power management for customers worldwide to avoid 40,000 tons of carbon dioxide emissions between FY08 and FY12.

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.

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