

Product Carbon Footprint (PCF) FAQs

Product Carbon Footprint (PCF) can be broadly defined as the total greenhouse gas (GHG) emissions, or CO₂-equivalent (CO₂e), generated during the production or full lifecycle of a product. Some organizations will consider different system boundaries when estimating PCFs, for example cradle-to-gate vs cradle-to-grave. The cradle-to-gate PCF, only includes those emissions produced prior to leaving the company’s “gate.” Other organizations consider cradle-to-grave PCF across the entire lifecycle, including the “Use” and “End of Life” (EOL) phases of the product.

Additional Materials: [PCF Whitepaper](#)

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1.1 What are Product Carbon Footprints and how can they be used?

The **Product Carbon Footprint** (PCF) of a product in a cradle-to-grave assessment, like the one that Dell uses, includes emissions related to four key product lifecycle stages:

- **Manufacturing Phase:** Includes assembly of the product, emissions from materials and manufacturing of its components and parts (e.g., drives, graphics cards, memory, CPU, mainboards, etc.)
- **Logistics or Transportation Phase:** Transportation of the parts, components, and products from suppliers and fulfillment centers, respectively, and ultimately to the customer
- **Use Phase:** Use of the products at customer locations in a given timeframe
- **EOL Phase:** End of life processing (i.e., recycling, refurbishing or disposal of the product.)

1.2 How are product carbon footprints used?

In general, PCFs create an estimate of potential carbon impacts of a product for the customer. Increasingly, there are requirements by ecolabels such as EPEAT and by customers to report PCF numbers to better demonstrate the environmental impact of a product. Surveys such as those administered by CDP - of which Dell has been a participant for many years - require reasonably accurate disclosures of an entity's CO₂e emissions. PCFs are a significant factor in this equation.

1.2.1 How are they calculated?

Dell uses a streamlined LCA tool called PAIA (Product Attribute to Impact Algorithm) to estimate PCFs. The tool is discussed below.

1.3 What is the PAIA methodology?

Dell, as well as some other IT companies, provide PCF estimates using PAIA, a streamlined product carbon footprint methodology based on IEC TR 62921, which is a quantification methodology for greenhouse gas emissions for Information Communication Technology (ICT) systems and broadly based on ISO 14040 and ISO 14044. It has been developed by MIT in an industry consortium. More details around PAIA can be found in the whitepaper [here](#).

PAIA estimates the GHG emissions associated with a product's lifecycle and is typically depicted by an average value, along with the appropriate standard deviation. The PAIA tool also provides product carbon footprint values at the 5th and 95th percentile to account for possible calculation uncertainties.

As sustainability impact reporting continues to evolve, we at Dell are actively participating in consortiums to improve the degree of accuracy in industry modeling and in our PCFs.

1.4 Is PAIA ISO Compliant?

There are various international standards used to provide guidelines, principles, and requirements for estimating environmental impacts such as ISO 14040, 14044, 14067, and IEC TR62921. Each standard details different approaches, requirements, and outputs, not all of which can be easily reconciled in a timely manner. Therefore, Dell and the industry use PAIA as a reasonable alternative to promptly respond to stakeholder PCF inquiries. Dell uses PAIA which follows IEC TR62921, which is a quantification methodology for greenhouse gas emissions for Information Communication Technology (ICT) systems to estimate product Carbon footprints, and as such is not compliant with the ISO 140xx guidelines.

1.5 Can carbon emissions calculated via PAIA be used to compare the PCF of different products, or PCF of different generations of the same product?

Generally, comparisons, either of results obtained through PAIA or via a method based on ISO 14040, are to be treated with caution due to variations in data quality, assumptions made, and methodological approaches. Dell is participating in a consortium to drive standards to create for standardized comparisons.

In cases where the manufacturer uses a standardized method, comparisons from generation to generation or between models of the manufacturer could be explored. However, a comparison between different brands will be uncertain due to the use of different data and assumptions.

The discrepancies introduced through differences in primary data, tools, modelling, etc. will be too large so results are always given with a deviation channel and/or formulated as an estimated impact.

These limitations of PCF should be considered when making related comparisons.

1.6 What is the difference between PCF and a Lifecycle Assessment (LCA)?

A full LCA is broader than a PCF study. Life Cycle Assessment (LCA) is a method to assess a range of multiple potential environmental impact categories associated with all phases of a product's life. A PCF only focuses on a single impact category, GWP (Global warming potential), while a full LCA will account for additional impact categories such as water consumption, acidification, ozone depletion, and resource depletion.

1.7 What factors can typically influence the total product carbon footprint?

Emissions generated during the product Use phase are determined by two main factors: the energy required by the equipment to run, and the location and source of the energy as different energy grids will yield different carbon emissions depending on the production method (renewable, coal, nuclear, etc.)

- Dell is continuously working to make our products more energy efficient. Since 2013, we have reduced the energy intensity of our product portfolio by 76% and our products are amongst the most energy efficient in the industry, certified with Energy Star. Our new 2030 target is to reduce absolute scope 3 GHG emissions associated with the use of sold products by 30%.
- Similar product configurations will have comparable energy draw regardless of use location. However, energy sourcing decisions like variations in the power grid and the electricity source our customers are using impact the carbon emissions associated with our products. For example, a Dell product plugged into a grid largely dependent on fossil fuels will have higher carbon emissions compared with that of a product plugged into a grid powered by solar or nuclear energy.

Emissions related to the **Manufacturing** of our products represent the raw materials used and the processes used for manufacturing parts and components.

- Obtaining detailed information on manufacturing impact areas (hotspots) allows us to work with our Original Design Manufacturers (ODMs) and suppliers to improve and reduce manufacturing emissions hotspots (for example by using sustainable energy, low-impact materials or better manufacturing processes).

1.8 Which has a greater PCF, client products or infrastructure products?

Key point(s) to note about PCFs:

- Emissions in Information Communication Technology (ICT) industry are mainly driven by the Manufacturing and Use of products.

On a unit-by-unit basis, PCF estimates (total across all 4 lifecycle stages) for Infrastructure products are typically much larger than estimates for Client products. This is primarily driven by differences in size, complexity and energy use.

- For Infrastructure products, the **Use phase** of total PCF is typically higher compared to other life cycle stages (unless these products are plugged into a fully renewable or green energy source)
- For Client products, the **Manufacturing phase** of total PCF is typically higher compared to other life cycle stages

1.9 Is the Product Carbon Footprint the same across configurations and / or geographic use?

No. As depicted in the graph below, the emissions for the manufacturing, transport and end-of-life phases remain static no matter where the configuration is being used. However, a variety of factors including the geographic location's energy mix and the specific hardware configuration have a significant impact on the Use phase of the product carbon footprint. This makes it difficult to assign a singular value across multiple configurations of a single Dell Technology product that could be used globally.

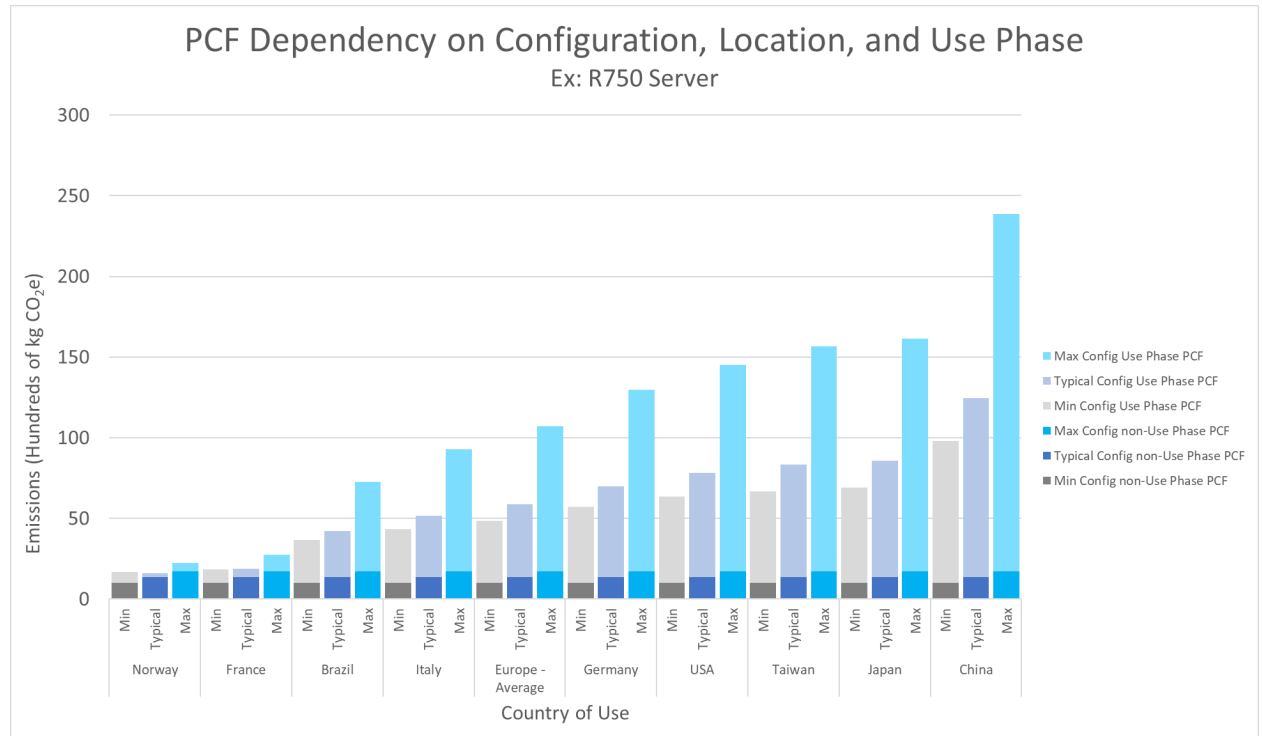


Figure 1 - PCF for multiple regions

1.10 What about the other lifecycle stages of PCF?

While Transportation and EOL phases of a PCF are relevant to many industries, emissions related to Transport and EOL are relatively lower for the ICT industry compared to the other 2 phases. Dell will continue focusing on emissions related to Transport and EOL for overall improvement of related emissions, while making significant strides of improvement on the Use Phase and Manufacturing Phase emissions.

1.11 How do scopes of emissions relate to product carbon footprints?

Scopes 1, 2 and 3 are typically corporate level accounts of greenhouse gas emissions whereas PCFs are carbon emissions at a product level. However, many of the scope 3 categories do correlate to phases within the product carbon footprint. Purchased goods and services, transportation and distribution, use of sold products, and product end of life treatment are examples of scope 3 categories with corresponding PCF phases.

1.12 Can a product's PCF change over time?

Yes. As our suppliers improve their processes and switch to renewable energy sources, the manufacturing footprint of the products they support may change.